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REGIONAL STORMWATER IRRIGATION FACILITIES

A Joint Research Program of





Submitted by

Marty Wanielista

Stormwater Management Academy University of Central Florida Orlando, FL 32816

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Nicole Runnebaum

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16. Abstract

The Florida Department of Transportation manages the runoff water from highways and other transportation related facilities, and frequently regional detention ponds are used. One potential use of detained runoff water in regional ponds is for irrigation. The pond water used for irrigation will reduce dependency on costly potable water for irrigation. The use of regional detention ponds is also attractive because irrigation of the detained water helps FDOT meet Total Maximum Daily Load restrictions for water bodies as well as to lower maintenance cost.

The use of regional ponds for irrigation can become more common if the occurrence of harmful algae can be minimized. Cyanobacteria counts and toxins are used as the measure of harmful algae. The counts and toxic concentrations are documented in regional detention ponds and after the detained water passes through soils. The algal count in regional ponds is three orders magnitude less than that found in central Florida lakes. The count and toxic levels after filtration through soils are less than that found in the regional ponds.

To remove the detained water through soils may be done using horizontal wells. To demonstrate the operation of a horizontal well, one is constructed adjacent to the shore line of a 15 acre regional pond. The well consistently produced a flow rate needed for the irrigation demand (500 gpm), and of a quality that meets public access irrigation quality standards.

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Executive Summary

The conclusion of this research is that regional ponds with horizontal wells can be used as a source of water for irrigation. This research is significant because the use of stormwater from regional ponds will reduce the amount of surface discharge pollutants from the ponds, and provide for an alternative water supply, that can be used for irrigation. Decreasing the quantity of water pollutants discharging into receiving waters will help meet total maximum daily load (TMDL) limits as well as lower the cost of maintenance of highway vegetation.

Regional ponds collect stormwater from watershed areas and these watershed areas are typically a combination of land uses. Examples of common land use classifications are highways, residential, commercial, industrial, agricultural, and natural undisturbed areas. These land uses contain pervious and impervious surfaces. Some of the pervious areas within the contributing land uses need irrigation water. The regional pond then serves as a source of irrigation water.

The use of regional ponds for irrigation can become more common if the occurrence of harmful algae can be minimized. Cyanobacteria counts and the Cyanotoxin Microcystin are used as the measure of harmful algae.

Fourteen regional ponds were sampled, which all had discharges from a roadway surface. The counts and toxic concentrations were documented in these regional detention ponds. Also, the fate of Cyanobacteria and the Cyanotoxin Microcystin is measured after regional pond water passes through soils. The algae count in regional ponds is at least three orders magnitude less than that found in central Florida lakes. The count and toxic level after filtration through soils is less than that found in the regional ponds.

Removal of detained regional pond water through soils may be done using horizontal wells. To demonstrate the operation of a horizontal well, one is constructed adjacent to the shore line of an existing regional pond on the campus of the University of Central Florida. The watershed has a four lane divided highway running through it with an average daily traffic count of about 80,000 vehicles. The 155.86 acre watershed is a mixed use area consisting of commercial, condominium, and recreational sport stadiums. The pond is 15 acres in area with a normal depth of eight feet. The well consistently produces a flow rate needed for the irrigation demand (500 gpm) and of a quality that meet public access irrigation quality.

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CHAPTER 1 – INTRODUCTION

Regional ponds collect stormwater from more than one classification of watershed or land use. The ponds can also serve as a source of irrigation water. A roadway is usually associated with each and every developed watershed, but there are many other land uses producing runoff. Examples of other land uses are: residential, commercial, industrial, agriculture, and natural or undisturbed. Irrigation for the pervious areas of these land uses is needed. Regional detention ponds can serve as the source of irrigation water; however, the water quality of the regional ponds used as a source of irrigation has not been documented. In particular, Cyanobacteria counts and toxic concentrations have not been measured. Furthermore, the currently used alternative water supply for irrigation is treated sewage (reclaimed water) which must be disinfected primarily using chlorine. Water in a stormwater pond may not need to be chlorinated, but could simply be filtered. Filtering the water through select soil materials or even the natural soils and then extracting it, using horizontal wells under and near a pond would not only be operationally easy, but may also produce a better water quality. Before installing and using the filters, it must first be shown that detained water can be extracted from a pond using a horizontal well.

In February of 2004, The Florida Department Transportation (FDOT) and the Florida Department of Environmental Protection (FDEP) funded research contracts to collect water quality data to support the concept of regional stormwater irrigation facilities. The sites selected for this research will receive stormwater from highways, but are regional in nature, and thus have input waters from other land uses. In addition, a regional facility will be constructed and initial operation will be demonstrated using a horizontal well. Runoff waters to the detention pond are from a four lane highway, an athletic complex, and a commercial area.

1.1 Objectives

The objectives of this research are:

- Develop an algal mass and toxin data base for regional stormwater ponds that have the potential to be used for irrigation.
- 2. Demonstrate the use of a horizontal well for the collection of irrigation quality water from a regional facility.

1.2 Limitations

The results are constrained by the location and climate in Florida. The water quality data base is limited to algal masses and toxins.

1.3 Approach

This report consists of six chapters. Provided in the first chapter is an introduction to the topic and also a description of the research objectives. In chapter two, a review of the current state of regional ponds and information related to algal counts and toxins is presented. The site selection criteria and description of the sites is covered in chapter three. In chapter four, results and discussion of the data are shown. The demonstration details for a reuse pond are presented in chapter five. In chapter six, a discussion, summary, conclusions, and recommendations are presented.

CHAPTER 2 – BACKGROUND

A regional facility for stormwater management is a detention pond that collects stormwater from more than one land use and usually includes runoff from roadways. The stormwater in the detention pond can be used for irrigation (Wanielista et.al., 1991). Currently, potable water is used in most parts of Florida for irrigating lawns, washing automobiles, and other consumptive uses. A non-potable source could be less costly relative to a potable source; however, some non-potable sources are becoming scarce. In 2003, eleven counties in Florida reported at least 85% of the reclaimed water is now used for non-potable uses (Water Reuse Work Group, 2003), and there is a demand for more than can be supplied. At the demonstration site for this research, a reclaimed line has been available for two years, but no reclaimed water was allocated. Thus, stormwater became a source to satisfy the demand for non-potable water.

Regional and even single watershed ponds are found throughout the State, especially in areas with high water tables. These ponds frequently discharge more water than they collect because of high water table and poorly drained soil conditions; however, some of the detained water can be used for irrigation. Some of the benefits of converting detention ponds to regional irrigation ponds are:

- 1. The regional irrigation pond will continue to assist in meeting Water Management District Environmental Resource Permits in terms of peak discharge and water quality management.
- 2. When using irrigation from the regional ponds, the volume of stormwater discharged to surface waters decreases relative to no-reuse, and thus total maximum daily loads (TMDL) of pollutants are reduced. Regional ponds with irrigation will help FDOT, other government agencies, and private developers meet the new TMDL regulations.
- 3. Drinking water is used for irrigation of lawns. The use of irrigation water from a regional

facility will replace the use of drinking water. This has a direct benefit in areas that rely on groundwater as the sole drinking water source. The drinking water supply is not only sustained, but wetlands dependent on the groundwater are enhanced and maintained as well.

- 4. The cost of providing water for drinking and irrigation purposes decreases because the irrigation water from the regional ponds will cost less than drinking water.
- 5. A regional irrigation pond as part of a FDOT highway project can be purchased with construction money. The operation can then be assumed by a stormwater utility or irrigation utility, thus improving the operational effectiveness of such systems.
- 6. In some groundwater protected areas, such as Springsheds, a yearly hydrologic water budget must be maintained. Thus, the use of detention ponds with irrigation can help in the maintenance of the annual hydrologic budget.

2.1 Past Research for the Design and Operation of a Reuse Stormwater Pond

Stormwater ponds are designed for pollution control and flood control. Pollution control can also be achieved in terms of mass removal by reducing the discharged volume of water. Furthermore, if the detained water is of acceptable quality it can be irrigated. Filtration of detained water through natural soils adjacent to ponds may be also possible, and may even improve water quality.

Gravity filtration systems in detention ponds were monitored to document operational and pollution removal effectiveness in the past (Wanielista, 1986, Harper and Miracle, 1993, and Dyer, Riddle, Mills and Precourt, Inc, 1995). These were shallow, wet detention ponds with bottom and bank filtration systems. The filtration depth was only a few inches to a few feet and the discharges from the filtration systems were not used for irrigation. The results of the

monitoring indicated that particulate species in the stormwater were reduced, but the average pollution removal effectiveness for dissolved species, especially nitrogen, was low, and in a few events total nitrogen was exported. In addition, clogging was a problem when peat or fine silt materials were used as the filtration materials (Nnadi, et.al., 1997).

Wet detention pond design criteria were thus modified to include the recovery of the pollution control volume using pumps for irrigation. These ponds are called stormwater reuse ponds, and are normally wet all year. The design criteria are listed in a FDEP report (Wanielista, et. al., 1991). Using these design criteria, a pond was designed and operated in Winter Park, Florida (Wanielista and J. Bradner, 1992). The documentation of the water quantity irrigation efficiencies for which this pond was designed validated the model used for sizing a wet detention pond for irrigation, and are based on the effective impervious area (Wanielista, et.al., 1997). For regional ponds, the design criteria are thus established and an example design curve, called a REV curve used for central Florida, is shown in Figure 1.

Biological organisms are naturally selected in a soil column and on the ground surface. Past studies indicate that hydrocarbon-degrading bacteria were naturally selected along highways and the number of bacteria decreased at a distance from the road edge. The population of bacteria was positively correlated with the amount of hydrocarbon substrate in the environments in ditches adjacent to highways (Wanielista, et.al., 1978). In other studies, (Wanielista, and Charba, et.al., 1991) it was demonstrated that granular activated carbon did decrease Trihalomethane Formation Potential.

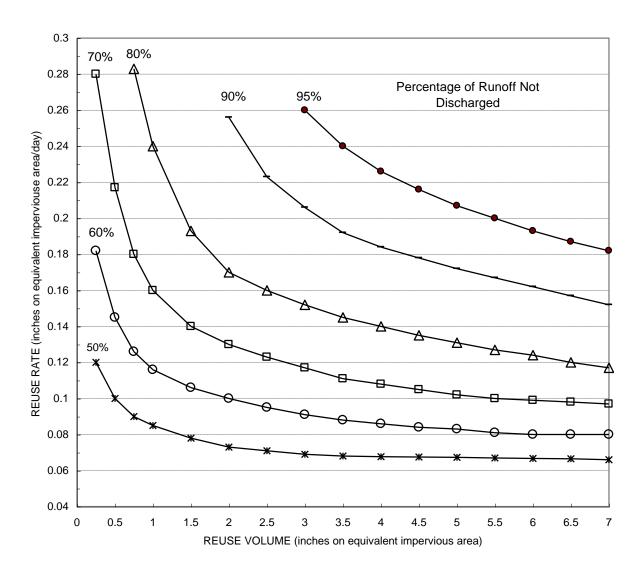


Figure 1: Reuse Curve for Designing a Reuse Volume and Irrigation Rate for Central Florida (From Wanielista, Yousef, et.al, 1991)

Within stormwater there are pollutants, classified as nutrients, organics, solids, metals, oils, bacteria, and others. The average loading rates for these have been documented (Harper, 1994, and Wanielista and Yousef, 1993, pg. 126). These pollutants are not found in high concentrations in irrigation quality waters, and thus some must be removed before irrigation. Some methods are better than others to remove pollutants, and there is excellent documentation of the watershed approach and the best management practices in many publications (Livingston,

et.al., 1988, Ruston, 2001, and Ruston, 2002). This research will concentrate on documenting the removal of public health related pollutants by soils and in regional ponds. In Figure two, there are two pond schematics, one for detention and one for retention. Both pond systems can be used to supply irrigation water.

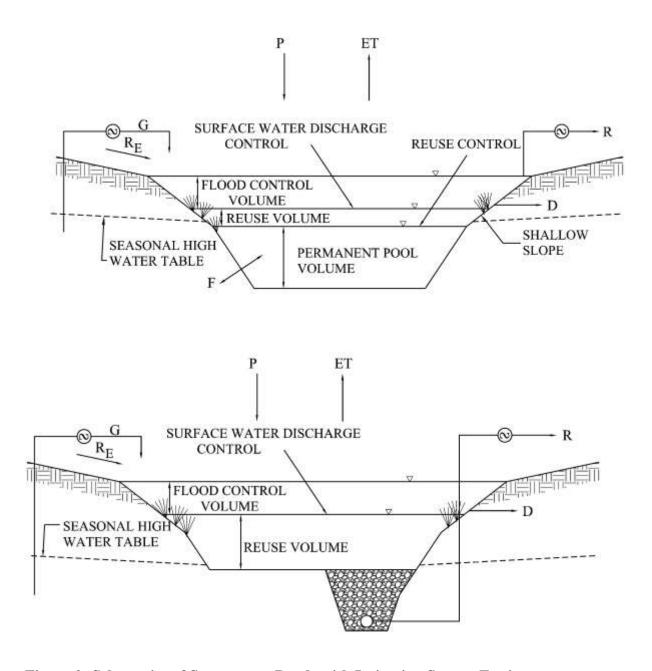


Figure 2: Schematics of Stormwater Ponds with Irrigation System Equipment

CHAPTER 3 – FIELD SITE DESCRIPTIONS

3.1 Site Selection

The necessity to evaluate stormwater ponds as a potential source of Cyanobacteria has become evident for several reasons. Cyanobacteria has been identified and documented within larger water bodies throughout the state of Florida, but very little investigation has been conducted on smaller water bodies. Stormwater ponds are an abundant and readily available water source and are a practical, commonly used source for irrigation. A stormwater pond located within residential area is regularly used for irrigation with little or no treatment prior to use. It is not uncommon for residents to pump water directly from the small water bodies for irrigation purposes. The tendency for algae to proliferate within these water bodies is easily observed by casual glances. Due to the extensive growth of Cyanobacteria in Florida waters and the potential for human exposure to airborne toxins associated with Cyanobacteria, the need for evaluation of these sources is evident.

Since small water bodies are just as susceptible to algae growth as large water bodies, stormwater and small residential ponds were selected for this study. The stormwater ponds that were selected are located in central Florida within the Orlando area. The ponds are located within residential developments (Lake Condel, Terrier Pond), on the University of Central Florida campus, near an industrial site (Lake Patrik), alongside a major expressway (SR 417) and by the side of heavily traveled urban roadways (Horatio Avenue, University Boulevard). The ponds for this study were chosen on the basis that they exhibit desirable characteristics as irrigation sources.

The occurrence of rainfall after a long period of no rainfall can influence algal blooms.

According to Orange County Environmental Protection Division (Bortles, 2005), the largest

blooms will occur within three to five days following a rain event provided that another rain event will not occur, but the rain event may hinder the algae growth.

3.1.1 Initial Site Selection

A windshield survey was conducted in order to evaluate potential pond sites for this investigation. This consisted of traveling along central Florida roads and residential areas to visually observe potential ponds that exhibited excessive algae growth. This method was used in conjunction with ponds recommended by the Orange County Environmental Protection Division that are currently being studied for Cyanobacteria.

3.1.2 Selected Regional Ponds with land use classifications

Residential

- 1 Lake Condel
- 2 Terrier Pond

University of Central Florida Campus

- 3 Irrigation Ponds
- 4 Pegasus Pond

Industrial

5 Lake Patrik

S.R. 417 - Greenway

- 6 NB, at Lee Vista Boulevard exit
- 7 SB, 0.5 miles south of Lee Vista Boulevard
- 8 NB, at SR 528 (Beeline) exit
- 9 NB, 2 miles north of Narcoossee Road
- NB, 1 mile north of Narcoossee Road

Urban Roadways

- 11 University Boulevard and Hall Road
- 12 University Boulevard and S.R. 417, NW corner
- 13 Horatio Avenue and Via Tuscany No. 1
- Horatio Avenue and Via Tuscany No. 2

The USGS Quadrangle and Soil Conservation Service (SCS) Soil Survey maps for each stormwater pond site and photographs are shown in the Appendix.

3.2 Pond Sampling

The sample depths utilized for this testing were within several inches of the water surface. This depth was selected because some ponds were shallow or with average depths in the dry season, of less than three feet. The sample locations were also limited to several feet of the water body's shoreline. For this study, samples were collected from an area in the pond where the algal blooms were present. Sampling from the deeper half (or lower) water column presented the potential for introducing pond bottom mud and decaying vegetation. This sampling technique also presented limitations due to the limited length, approximately six feet long, of the sampling pole used to collect the sample. Additionally, wading into the water body was not practiced during the sampling events. Samples that were collected near the water surface may have reduced levels of bacteria due the utilization of the necessary nutrients by competing vegetation, such as duckweed, which is prominent at many of the pond locations.

There were many method and materials utilized to collect the samples. One of these materials included a six-foot long PVC pole with an attachment to hold a 1-liter amber sample bottle. The bottles were rinsed three times with the pond water prior to collecting the sample to be analyzed. The sampling technique itself involved keeping the open end of the sample bottle facing downward as the bottle was immersed into the pond. This was done to minimize the chance of water entering the bottle prior to reaching the desired depth.

Samples were collected for pH and alkalinity during the months of October, December and February, when Cyanobacteria growth is most likely not at its peak growth. Temperatures

above 25 degrees Celsius promote the highest level of Cyanobacteria growth (Chorus and Bartram, 1999), but the algae are able to grow at temperatures ranging from 17 to 22 degrees Celsius (Kurmayer et al., 2002). Although conditions were conducive for bacteria growth based on observations of algae blooms in the ponds and information provided by Orange County, more favorable conditions were experienced during the warmer months of the spring and summer. These conditions supported a more active growing season for the bacteria. Samples were collected during April and August to satisfy the more desirable conditions for algal growth. It was also noted that samples collected during the summer months at Lake Condel in previous years by Orange County were also observed to exhibit readily detectable levels of Cyanobacteria. These samples were obtained as part of a previous study and were collected by Orange County as part of the ongoing study of Cyanobacteria levels within Lake Condel (Bortles, 2005).

3.3 Filtrate Sampling

Pond stormwater was added to four chambers with A-3 soils (poorly-graded) since these soils were the most common soils found near or at the stormwater ponds. Samples for analyses were taken four feet below the chamber surfaces. Three of the chambers were covered with grass and one was not covered. Amber bottles were used for sampling.

CHAPTER 4 – ALGAL RESULTS AND DISCUSSION

Within this Chapter, Cyanobacteria population counts, potentially toxic (PTOX) counts, and toxin concentrations are reported for stormwater ponds and filtrate. The filtrate was obtained after 50 inches of pond waters (from S.R. 417-1, Pegasus and Lake Condel ponds) passed through four feet of a poorly graded sandy soil typical of that on the campus of UCF. The next data reported are comparisons between data sets from this sampling and between one other lake's data set.

The methods and analyses used to determine the population and concentration were performed by the same laboratory, namely GreenWater Laboratories of Palatka, Florida. An initial analyses was conducted at the University of Central Florida and thus indicated the presence of Cyanobacteria, but was not quantified. The use of the GreenWater Laboratory for comparative quantitative analyses minimized the potential variations in analytical results so that the counts and concentrations determined could be compared without variability between labs. The use of one lab minimized the possibility of different techniques from different laboratories, which may have provided additional variance for populations and concentrations. In addition, a previous study for lake populations was performed by GreenWater and thus the comparisons to that lake data also reduce variability possibilities among labs.

4.1 Cyanobacteria Populations

Forty-five stormwater ponds in central Florida were visited and past sampling results from Orange County helped identify potential ponds for the research. Of these 45 ponds, 24 had indications of blue green algal activity. Those 24 ponds were again sampled and 14 of them

were identified qualitatively as having blue green algal blooms. These same ponds also had the visual appearance of the algae. Also, there was different land use associated with these 14 ponds, which were a criterion for choice. Terrier Pond was sampled at two locations because it has a history of Cyanobacteria populations and resident respiratory problems.

Total Cyanobacteria and potential toxic (PTOX) counts per milliliter are shown in Table 1 for two sampling periods, April, which is the start of the visible bloom activity, and August, in

Table 1: Total and PTOX Counts for Two Sampling Periods

APRIL 2005 AUGUST 2005

Sample	Total	PTOX	Sample	Total	PTOX
Description	CYANO	CYANO	Description	CYANO	CYANO
_	Units/mL	Units/mL		Units/mL	Units/mL
Filtrate #1	1,167	0	Filtrate #1	2,928	1
Filtrate #2	130	0	Filtrate #2	686	0
Filtrate #3	751	0	Filtrate #3	650	0
			Filtrate #4	1,231	0
			Filtrate #4 replicate	583	0
Residential					
Lake Condel	12,590	227	Lake Condel	36,412	1,844
Terrier Pond East	650	499	Terrier Pond East	1,746	191
Terrier Pond South	2,223	635	Terrier Pond South	1,501	265
University of Central Florida Campus					
Irrigation Ponds	298	0	Irrigation Ponds		
Pegasus	1,387	68	Pegasus	3,450	38
Industrial					
Lake Patrik	557	390	Lake Patrik	5,011	3,759
SR 417 Roadways					
SR 417-1	824	476	SR 417-1	33,640	20,691
SR 417-2	2,620	1,427	SR 417-2	17,578	14,312
SR 417-3	1,005	183	SR 417-3	11,038	5,897
SR 417-4	3,267	2,814	SR 417-4	13,797	9,064
SR 417-5	491,690*	318	SR 417-5	499	4
Urban Roadways					
Hall Road	389	0			
Horatio 1	0	0	Horatio 1	7,825	2,681
Horatio 2	270	0	Horatio 2	613	8
University & SR 417 NW	420	11			

^{*} Not included in statistical analyses

the middle of algal bloom activity. The filtrate PTOX counts were at or near zero, while the detention ponds had identifiable counts. Alkalinity and pH were recorded 34 times and averaged 45 mg CaCO₃ per mL and 7.4 respectively with standard deviations of 10.5 and 0.4. Comparisons for average counts among land uses are shown below in Figure 3.

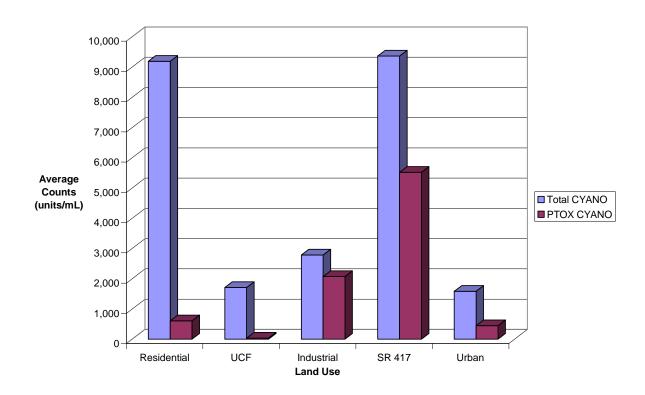


Figure 3: Comparison of Total and PTOX Cyanobacteria Average Counts vs. Land Use

The average Cyanobacteria counts for the stormwater ponds were 34,546 total and 470 PTOX in April with standard deviations of 3,113 and 724 respectively. One result for total count at SR 417-5 was eliminated from the average calculations because it was greater than three standard deviations from the mean, and likely was in error. For the filtrate, the averages were 682 and 0 counts with standard deviations of 426 and zero respectively. For the August 2005 sampling, the averages were 11,093 total and 4,896 PTOX with standard deviations of 11,924 and 6,371 respectively. For the filtrate, the averages were 1,216 total and 0.2 PTOX with

standard deviations of 887 and 0.4 respectively. Thus, on average and for field data, the filtration was removing both total counts and PTOX levels of Cyanobacteria.

4.2 Stormwater and Lake Cyanobacteria Population Comparisons

For central Florida lakes, data on total and PTOX counts are available from GreenWater laboratories. These data are shown in Table 2. If we compare the results from the stormwater ponds to those of the central Florida lakes, the stormwater ponds total Cyanobacteria counts and the potentially toxic Cyanobacteria counts (PTOX) averages are much lower.

Table 2: Total and PTOX Populations in Central Florida Lakes

Sample	Sampling	Total CYANO	PTOX
Description	Date	Units/mL	Units/mL
Lake Apopka	Year 1	1,361,860	13,550
	Year 2	1,136,098	1,864
Lake Beauclair	Year 1	650,370	154,190
	Year 2	449,210	69,420
Lake Dora	Year 1	581,110	144,590
	Year 2	500,196	129,510
Lake Eustis	Year 1	<285,000	
	Year 2	<285,000	40,520
Lake Griffin	Year 1	<285,000	
	Year 2	<285,000	
Lake Harris	Year 1	235,570	
	Year 2	116,700	41,990
Lake Yale	Year 1	<285,000	
	Year 2	<285,000	

from:

Chapman et al, 2004, "Cyanobacteria Populations in Seven Central Florida Lakes" 15th Annual Conference of the Florida Lake Management Society, Tampa Florida

There was not a count on the number of samples associated with the lake data, and thus no statistical comparisons could be done. However, the pond count average data are about two orders of magnitude lower than the lake data. For the April sampling, there was only one stormwater pond total count that was higher than the lake total counts, and the value reported for

Lake Harris (491,690 Units/mL vs. 116,700 Units/mL). In addition, there was one PTOX count exceeding the lake Apopka PTOX count (2,814 Units/mL vs. 1,864 Units/mL). The second sampling event did not have a total counts that exceeded the lake counts, but for six stormwater ponds, PTOX counts were greater than those at Lake Apopka. Thus, the PTOX values in the stormwater ponds indicate that they are approximately equal at least in magnitude to those in lakes and thus if the lakes are used to supply irrigation water, then the ponds can also be used based only on PTOX.

4.3 Cyanobacteria Comparisons between Pond and Filtrate

The PTOX counts in stormwater ponds that can be used for irrigation lead to the question, "Can total and PTOX in ponds be removed by filtration using a naturally occurring soil?" For sampling in April 2005, the total pond water Cyanobacteria counts are significantly different from the filtrate total counts at the 75% level of significance. The stormwater pond PTOX counts are significantly different from the filtrate PTOX counts at the 85% level of significance. The data for these statistical analyses are shown in Table 3.

Table 3: Ponds vs. Filtrate Comparisons with Statistics April 2005

Description	Date	Total	PTOX
		Units/mL	Units/mL
Filtrate #1	4/15/2005	1,167	0
Filtrate #2	4/15/2005	130	0
Filtrate #3	4/15/2005	751	0
Residential			
Lake Condel	4/17/2005	12,590	227
Terrier Pond East	4/17/2005	650	499
Terrier Pond South	4/17/2005	2,223	635
University of Central Floric	la Campus		
South Irrigation	4/17/2005	298	0
Pegasus	4/17/2005	1,387	68
Industrial			
Lake Patrick	4/17/2005	557	390
SR 417 Roadways			
SR 417-1	4/17/2005	824	476
SR 417-2	4/17/2005	2,620	1,427
SR 417-3	4/17/2005	1,005	183
SR 417-4	4/17/2005	3,267	2,814
SR 417-5	4/17/2005	*	318
Urban Roadways			
Hall Road	4/17/2005	389	0
Horatio 1	4/17/2005	0	0
Horatio 2	4/17/2005	270	0
University and SR 417 NW	4/17/2005	420	11

^{*} not included in statistical analyses

Table 4: Continued Ponds vs. Filtrate Comparisons with Statistics April 2005

	Γ	Total	PTOX
		CYANO	CYANO
X bar 1	Pond AVG	1,893	470
X bar 2	Filtrate Avg	682	0.000
S1	STD DEV Ponds	3113	724
S2	STD DEV Filtrate	426	0.000
n1	# of Pond samp	14	15
n2	# of Filtrate samp	3	3
note: n1+n2=		17	18
thus use t statistic	t Statistic	Total	PTOX
		CYANO	CYANO
	X1bar-X2bar	1,210	470
	(n1-1)*S^2	125970429	7340754
	(n2-1)*S^2	363073	0.000
	n1+n2-2	15	16
	(1/n1+1/n2)	0.40476	0.40000
	SQRT	1846	428
	t	0.656	1.097
	significant difference	>75%	>85%

For sampling on April 15 through 17, 2005

For sampling in August 2005, the pond water total Cyanobacteria population counts were significantly different from the filtrate Cyanobacteria counts at the 95% level of confidence. The stormwater pond PTOX counts are significantly different from the filtrate PTOX counts at the 90% level of significance. The data used for these statistical analyses are shown in Table 5.

¹⁾ The pond water total cyanobacteria counts are significantly different from the filtrate cyanobacteria counts at the 75% level of significance.

²⁾ The potentially toxic cyanobacteria counts are significantly different from the filtrate potentially toxic counts at the 85% level of significance

Table 5: Ponds vs. Filtrate Comparisons with Statistics August 2005

Sample	Sampling	Total	PTOX
Description	Date	CYANO	CYANO
		Units/mL	Units/mL
Filtrate #1	8/7/2005	2,928	1
Filtrate #2	8/7/2005	686	0
Filtrate #3	8/7/2005	650	0
Filtrate #4	8/7/2005	1,231	0
Filtrate #4b	8/7/2005	583	0
Residential			
Lake Condel	8/7/2005	36,412	1,844
Terrier Pond East	8/7/2005	1,746	191
Terrier Pond South	8/7/2005	1,501	265
University of Centra	al Florida		
South Irrigation			
Pegasus	8/7/2005	3,450	38
Industrial			
Lake Patrick	8/6/2005	5,011	3,759
SR 417 Roadways			
SR 417-1	8/7/2005	33,640	20,691
SR 417-2	8/7/2005	17,578	14,312
SR 417-3	8/7/2005	11,038	5,897
SR 417-4	8/7/2005	13,797	9,064
SR 417-5	8/7/2005	499	4
Urban Roadways			
Horatio 1	8/7/2005	7,825	2,681
Horatio 2	8/7/2005	613	8

		Total	PTOX
_		CYANO	CYANO
X bar 1	Pond AVG	11,093	4,896
X bar 2	Filtrate Avg	1,216	0.200
S1	STD DEV Ponds	11924	6371
S2	STD DEV Filtrate	887	0.400
n1	# of Pond samp	12	12
n2	# of Filtrate samp	5	5
note: n1+n2=		17	17

thus use t statistic

t Statistic	Total	PTOX
	CYANO	CYANO
X1bar-X2bar	9,877	4,896
(n1-1)*S^2	1564125679	446458710
(n2-1)*S^2	3146580	0.640
n1+n2-2	15	15
(1/n1+1/n2)	0.28333	0.28333
SQRT	5441	2904
t	1.815	1.686
significant difference	>95%	>90%

For sampling on August 6 through 7, 2005

- 1) The pond water total cyanobacteria counts are significantly different from the filtrate cyanobacteria counts at the 95% level of confidence.
- 2) The potentially toxic cyanobacteria counts are significantly different from the filtrate potentially toxic counts at the 90% level of significance

For the combined sampling data of April and August 2005, the pond water total Cyanobacteria counts are significantly different from the filtrate Cyanobacteria counts at the 99% level of confidence. The potentially toxic Cyanobacteria counts (PTOX) are significantly different from the filtrate potentially toxic counts (PTOX) at the 99% level of significance. The data used for the statistical analyses are shown in Table 6.

Table 6: Ponds vs. Filtrate Comparisons Combined Data and Statistics

	.		
		Total	PTOX
		CYANO	CYANO
X bar 1	Pond AVG	6,139	2,437
X bar 2	Filtrate Avg	1,016	0.125
S1	STD DEV Ponds	9,585	4,813
S2	STD DEV Filtrate	791	0.331
n1	# of Pond samp	26	27
n2	# of Filtrate samp	8	8
note n1+n2=	thus use Z statistic	34	35
	Z Statistic	Total	PTOX
		CYANO	CYANO
	X1bar-X2bar	5,123	2,437
	S1^2/n1	3,533,814	858,053
	S2^2/n2	78,303	0.014
	SQT RT	1901	926
	Z	2.70	2.63
	level of confidence	>99%	>99%

For the combined sampling of April 17 and August 7, 2005,

- 1) The pond water total cyanobacteria counts are significantly different from the filtrate cyanobacteria counts at the 99% level of confidence.
- 2) The potentially toxic cyanobacteria counts are significantly different from the filtrate potentially toxic counts at the 99% level of significance

Figure 4 on the following page presents a graphical representation for the average total and PTOX Cyanobacteria counts using the combined data from both sampling events.

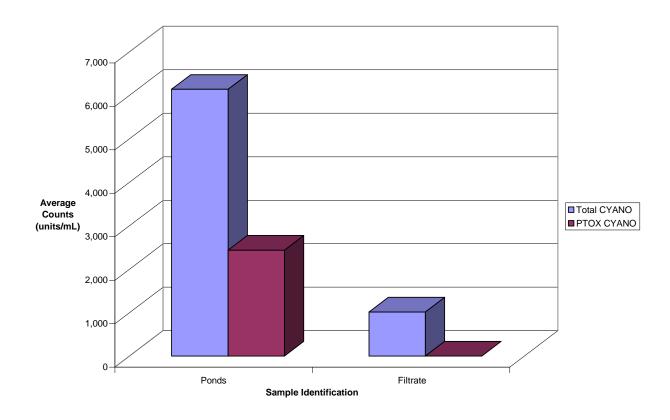


Figure 4: Pond vs. Filtrate Cyanobacteria Comparisons Using Combined Data

4.4 Cyanobacteria Toxin Concentrations

Cyanobacteria toxin concentrations were quantified using the ELISA method. These concentrations were provided by GreenWater laboratory. The toxin concentrations and the associated quality control data are shown in Tables 7 and 8. The average pond concentrations for all sites for each sampling period were 0.22 and 0.33 mg/L for the April and August sampling periods respectively. The filtrate averages were 0.23 and less than 0.04 mg/L for the April and August sampling periods respectively. The water applied to the soil columns were from the Pegasus and Lake Condel stormwater ponds. These ponds were thought to have higher concentrations of Toxins but the concentrations were relatively low (<0.04 to 0.17 mg/L). From

a statistical analysis, comparing the mean values of toxin Microcystin in the ponds to the filtrate values, the results from the sampling event in April showed no significant difference existed between the two.

However, the second sampling event in August, 2005 indicated that a significant difference did exist at the level of confidence of approximately 88%. Additionally, the level of confidence when the values from both sampling events were combined was on the order of 97% for the Microcystin filtering process. A graphical comparison of the average Microcystin concentration data (ug/L) for the ponds and the filtrate is shown in Figure 5. The graph visually indicates the difference in the average values.

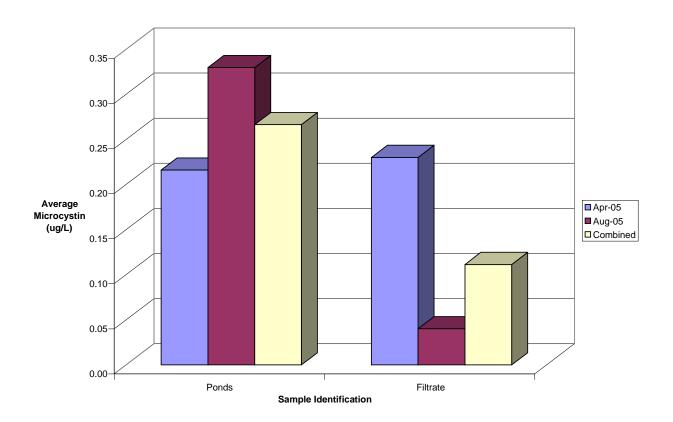


Figure 5: Ponds vs. Filtrate Microcystin Data

Table 7: Microcystin Concentrations for April 2005

ELISA Method Sampled in April 2005

ELISA Method Sampled in A	April 2005		Standard	Corrected	Final		
Sample ID	Assay Value (ug/L)	Final Conc. Factor	Standard Recovery (%)	Spike Recovery (%)	Corrected Concentration (ug/L)	(ug/L)	
Filtrate #1	0.10 0.05	1 x 1 x	74 74	78 78	0.17 0.09	0.13	0.06
Filtrate #2	0.12 0.14	1x 1x	83 83	89 89	0.16 0.19	0.18	0.02
Filtrate #3	0.28 0.29	1x 1x	83 83	89 89	0.38 0.39	0.39	0.01
Hall Rd	0.10 0.13	1x 1x	98 98	66 66	0.15 0.20	0.18	0.04
South Irrigation	0.24 0.29	1x 1x	74 74	73 73	0.44 0.54	0.49	0.07
Lake Patrick	0.08 0.10	1x 1x	74 74	77 77	0.14 0.18	0.16	0.03
Lake Condel	0.12 0.14	1x 1x	98 98	81 81	0.15 0.18	0.17	0.02
Terrier Pond East	0.09 0.07	1x 1x	90 90	92 92	0.11 0.08	0.10	0.02
Terrier Pond South	0.05 0.11	1x 1x	90 90	92 92	0.06 0.13	0.10	0.05
Pegasus Pond	0.11 0.13	1x 1x	98 98	80 80	0.14 0.17	0.16	0.02
SR 417-1	0.36 0.27	1x 1x	90 90	92 92	0.43 0.33	0.38	0.07
SR 417-2	0.49 0.45	1x 1x	98 98	80 80	0.62 0.57	0.60	0.04
SR 417-3	0.10 0.14	1x 1x	98 98	93 93	0.11 0.15	0.13	0.03
SR 417-4	0.14 0.14	1x 1x	98 98	72 72	0.20 0.20	0.20	0.00
SR 417-5	0.17 0.19	1x 1x	98 98	97 97	0.18 0.20	0.19	0.01
University and SR 417 NW	0.09 0.12	1x 1x	98 98	78 78	0.12 0.16	0.14	0.03
Horatio 1	0.06 0.07	1x 1x	90 90	87 87	0.08 0.09	0.09	0.01
Horatio 2	0.12 0.19	1x 1x	90 90	93 93	0.14 0.23	0.19	0.06

 $\begin{aligned} &Quantification \ limit = 0.04 \ \mu g/L \\ &No \ dilution \ ratio \ necessary \end{aligned}$

To provide additional evidence for the sorption of Microcystin on soil particles, laboratory batch studies were conducted to provide another estimate of the potential for adsorption of Microcystin (MC) onto soil. Microcystin-LR (MC-LR) solutions (50 mL) were prepared from commercially available standard and distilled water and were mixed with 10 g of sand for up to 46 hours. Microcystin concentrations were determined by the ELISA method.

Reductions in Microcystin concentrations ranged from 13 to 32 % (O'Reilly and Wanielista, 2006). Sorption processes likely explain this reduction because microbial degradation of MC-LR has been reported to require a three-day lag before commencing (Miller et al, 2001). In response to degradation problem, adsorption isotherms were developed, resulting in a slightly better fit to a Freundlich rather than linear isotherm. These results are consistent with findings reported by Miller et al (2001) who reported a linear isotherm coefficient of 0.80 L/kg for a sandy soil.

Table 8: Microcystin Concentrations for August 2005

ELISA Method Sampled	in August	2005	Assay	Standard	Corrected Spike	Final Corrected	Average	
Sample ID	Dilution Ratio	Final Conc. Factor	Value (ug/L)	Recovery (%)	Recovery (%)		Concentration (ug/L)	Standard Deviation
Filtrate #1	0	1x	0.02	77	98	< 0.04	< 0.04	0.00
	0	1x	0.03	77	98	< 0.04		
Filtrate #2	0	1x	0.02	77	98	< 0.04	< 0.04	0.00
	0	1x	0.02	77	98	< 0.04		
Filtrate #3	0	1x	0.03	77	98	< 0.04	< 0.04	0.00
	0	1x	0.01	77	98	< 0.04		
Filtrate #4	0	1x	0.02	77	98	< 0.04	< 0.04	0.00
	0	1x	0.02	77	98	< 0.04		
Filtrate #4b	0	1x	0.03	77	98	< 0.04	< 0.04	0.00
	0	1x	0.03	77	98	< 0.04		
Lake Patrick	0	1x	0.04	88	89	0.04	0.05	0.01
	0	1x	0.05	88	89	0.06		
Terrier Pond East	0	1x	0.07	88	89	0.08	0.06	0.03
	0	1x	0.04	88	89	0.04		
Terrier Pond South	0	1x	0.06	88	89	0.07	0.08	0.01
	0	1x	0.07	88	89	0.08		
SR 417-5	0	1x	0.08	88	89	0.09	0.12	0.04
	0	1x	0.13	88	89	0.15		
SR 417-4	0	1x	0.11	102	98	0.11	0.15	0.06
	0	1x	0.10	102	98	0.19	0.20	0.00
SR 417-3	0	1x	0.09	102	98	0.09	0.09	0.00
	0	1x	0.09	102	98	0.09		
SR 417-1	1/10	10x	1.64	54	94	1.74	1.36	0.54
	1/10	10x	0.92	54	94	0.98	1.00	0.0 .
SR 417-2	0	1x	1.33	54	94	1.41	1.56	0.21
	0	1x	1.61	54	94	1.7		
Lake Condel	0	1x	0.02	102	98	0.02	0.04	0.03
Zano Conder	0	1x	0.06	102	98	0.06	•••	0.02
Horatio 1	0	1x	0.45	54	94	0.48	0.45	0.04
	0	1x	0.40	54	94	0.42		
Horatio 2	0	1x	0.03	102	98	< 0.04	< 0.04	0.00
11014110 2	0	1x	0.03	102	98	< 0.04		0.50
Pegasus Pond	0	1x	0.01	102	98	< 0.04	< 0.04	0.00
1 054040 1 0114	0	1x	0.01	102	98	< 0.04	· V•04	0.00

Quantification limit = 0.04 μ g/L

Table 9: Statistical Analyses: Pond vs. Filtrate Microcystin Data

Single Sample Run Date of April 2005

Single Sample Run Date of August 2005

Null Hypothesis: Xbar 1 > Xbar2 (0ne sided)

Null Hypothesis: Xbar 1 > Xbar2 (0ne sided)

X bar 1	Pond AVG	0.
X bar 2	Filtrate Avg	0.
S1	STD DEV Ponds	0.
S2	STD DEV Filtrate	0.
n1	# of Pond samp	
n2	# of Filtrate samp	
note: n1+n2=	_	

X bar 1	Pond AVG	0.33
X bar 2	Filtrate Avg	0.04
S1	STD DEV Ponds	0.52
S2	STD DEV Filtrate	0.00
n1	# of Pond samp	12
n2	# of Filtrate samp	5
note: n1+n	2=	17

t Statistic

t Statistic	Toxin
X1bar-X2bar	-0.014
(n1-1)*S1^2	0.297
(n2-1)*S2^2	0.025
n1+n2-2	16
(1/n1+1/n2)	0.400
SQRT	0.090
t	-0.156
significant difference	>55%

X1bar-X2bar	0.290
(n1-1)*S1^2	2.970
(n2-1)*S2^2	0.000
n1+n2-2	15
(1/n1+1/n2)	0.283
SQRT	0.237
t	1.223
significant difference	~88%

Toxin

not a significant difference

Combined Sampling Data

Null Hypothesis: Xbar 1 > Xbar2 (0ne sided)

X bar 1	Pond AVG	0.266
X bar 2	Filtrate Avg	0.111
S1	STD DEV Ponds	0.367
S2	STD DEV Filtrate	0.114
n1	# of Pond samp	27
n2	# of Filtrate samp	8
note n1+n2=		35
	1	
	Z Statistic	I otal
	X1bar-X2bar	Total 0.155
	X1bar-X2bar	0.155
	X1bar-X2bar S1^2/n1	0.155 0.005
	X1bar-X2bar S1^2/n1 S2^2/n2	0.155 0.005 0.002
	X1bar-X2bar S1^2/n1 S2^2/n2 SQT RT	0.155 0.005 0.002 0.081

4.5 Pond Volume and Cyanobacteria Populations

Lake data shows population counts and concentrations that are at least two orders of magnitude greater than the stormwater ponds, with the lakes being much larger in volume and area relative to the stormwater ponds. Due to the magnitude difference, comparisons of stormwater pond volumes to the population counts and concentrations were made using the stormwater pond data. The data for pond area, average depth, and volumes along with an estimate of the watershed areas are shown in Table 10. The area data were obtained from recent air reconnaissance. The volumes were calculated from the area and an average depth, which was obtained using sounding equipment. For all of the ponds, side slopes were documented until a relatively constant depth was recorded across a pond. Depth was measured through many sections of the ponds and recorded when the change in depth was over about half foot. An average depth was calculated and the volume obtained as a function of the average depth and area. This volume is estimated as that relatively close to the pond control elevation and representative of the sampling times.

Table 10: Stormwater Pond Area, Depth, and Volume Data

Name	Pond Area (acre)	Estimated Watershed Area*** (acre)	Watershed Type	Approximate Average Depth* (ft)	Number of Measured Points	Approximate Volume** (acre-ft)
1 Lake Condel	2.7	135	Residential	10	80	27
2 Terrier Pond	4.6	230	Residential	14	100	64
3 UCF South Irrigation Pond off Campus Road	4.4	220	Roads & Parking	6	80	26
4 UCF Pegasus Pond off Campus Road	0.6	30	Roads & Parking	6	40	3.6
5 Lake Patrik	9.4	470	Roads & Parking	11	50	103
6 SR 417-1, NB at Lee Vista Boulevard Exit	1.7	85	4 Lane Divided	8	40	14
7 SR 417-2, SB 0.5 miles south of Lee Vista Boulevard	1.8	90	4 Lane Divided	8	40	14
8 SR 417-3, NB at SR 528 (Beeline) exit	3.5	175	4 Lane Divided	8	40	28
9 SR 417-4, NB 2 miles north of Narcoossee Road	3.3	165	4 Lane Divided	8	40	26
10 SR 417-5, NB 1 mile north of Narcoossee Road	2.0	100	4 Lane Divided	8	40	16
11 University Boulevard and Hall Road	0.9	45	6 Lane Curbed	4	20	3.6
12 University Boulevard and SR 417, NW corner	4.6	230	6 Lane Curbed	6	40	28
13 Horatio Avenue and Via Tuscany No. 1	1.1	55	4 Lane Curbed	4	20	4.4
14 Horatio Avenue and Via Tuscany No. 2	0.2	10	4 Lane Curbed	3	10	0.6

^{*} Average Depth

Both the sampling data of April and August showed no correlation between the pond volumes and the population counts, nor any correlation between pond volume and PTOX counts. The lack of correlation is shown by the statistical data and calculations in Table 11 through Table 14 for each sampling period. Thus, larger volume stormwater ponds do not have greater counts of Cyanobacteria relative to smaller ones, presumably because of proportional use of rooted vegetation (littoral zone) in all the ponds that remove nutrients.

Graphical presentations of the pond volume data and average total and PTOX were also made to visually compare the potential relationship. This comparison is shown in Figure 6.

^{**} Surface Area Multiplied by Average Depth

^{***} Based on 2% of the Watershed used for Pond Area

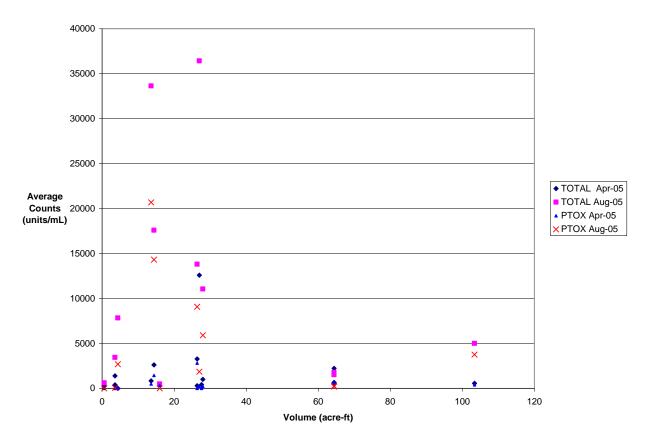


Figure 6: Pond Volume vs. Total and PTOX Counts

Table 11: Statistical Comparison of Pond Volume to Populations Counts in April 2005

	Approx	Total
	Volume	CYANO
	(acre-ft)	Units/mL
Lake Condel	27	12590
Terrier Pond	64	650
Terrier Pond	64	2223
UCF South Pond	26	298
UCF Pegasus Pond	3.6	1387
Lake Patrik	103	557
SR 417-1	14	824
SR 417-2	14	2620
SR 417-3	28	1005
SR 417-4	26	3267
Univ & Hall Road	3.6	389
Horatio Avenue No. 1	4.4	0
Horatio Avenue No. 2	0.6	270
Univ & SR 417, NW	28	420

SR 417-5 Sample Omitted

23092.92	135660462	-5.32746
SSxx	SSyy	SSxy

Xave	29.1	slope	-0.000231	S	3362
yave	1893	SSE	135660462	t	-0.0000104
n	14			t	0.0000104
		•		table t	13%

Table 12: Statistical Comparison of Pond Volume to Population Counts in August 2005

	Approx Volume (acre-ft)	Total CYANO Units/mL
Lake Condel	27	36412
Terrier Pond	64	1746
Terrier Pond	64	1501
UCF Pegasus Pond	3.6	3450
Lake Patrik	103	5011
SR 417-1	14	33640
SR 417-2	14	17578
SR 417-3	28	11038
SR 417-4	26	13797
SR 417-5	16	499
Horatio Avenue No. 1	4.4	7825
Horatio Avenue No. 2	0.6	613

not sampled
Univ & Hall Road
UCF South Pond Univ & SR 417, NW

21877	1728997274	-912584
SSxx	SSyy	SSxy

Γ	Xave	30.5	slope	-41.7	S	13004
	yave	12467	SSE	1690929877	t	-0.474475
	n	12			t	0.47448
			-		table	48%

Table 13: Statistical Comparison of Pond Volume to PTOX in April 2005

	Approx Volume (acre-ft)	PTOX CYANO Units/mL
Lake Condel	27	227
Terrier Pond	64	499
Terrier Pond	64	635
UCF South Pond	26	0
UCF Pegasus Pond	3.6	68
Lake Patrik	103	390
SR 417-1	14	476
SR 417-2	14	1427
SR 417-3	28	183
SR 417-4	26	2814
SR 417-5	16	318
Univ & Hall Road	3.6	0
Horatio Avenue No. 1	4.4	0
Horatio Avenue No. 2	0.6	0
Univ & SR 417, NW	28	11

23349	7865094	32428
SSxx	SSyy	SSxy

Xave	28.3	slope	1.39	S	776
yave	470	SSE	7820058	t	0.27362
n	15			t	0.27362
		•		table	7%

Table 14: Statistical Comparison of Pond Volume to PTOX in August 2005

	Approx	PTOX
	Volume	CYANO
	(acre-ft)	Units/mL
Lake Condel	27	1844
Terrier Pond	64	191
Terrier Pond	64	265
UCF Pegasus Pond	3.6	38
Lake Patrik	103	3759
SR 417-1	14	20691
SR 417-2	14	14312
SR 417-3	28	5897
SR 417-4	26	9064
SR 417-5	16	4
Horatio Avenue No. 1	4.4	2681
Horatio Avenue No. 2	0.6	8

not sampled

Univ & Hall Road
UCF South Pond
Univ & SR 417. NW

20298.68	489280520	-539528			
SSxx	SSyy	SSxy			
Xave	27.0	slope	-26.6	S	6892
yave	4465	SSE	474940170	t	-0.54949
n	12			t	0.54949
	_			table	41%

CHAPTER 5 HORIZONTAL WELL DEMONSTRATION

A solution to water shortages in Florida is to reuse water. Water used for irrigation and food production accounts for about 80 to 90% of water used worldwide. One of the most abundant sources for irrigation is stormwater. After rainfall occurs, water travels into ditches, ponds, lakes and other receptors before finally making its way to the saline water bodies of the world. This stormwater can be recovered by removing it from these impoundments, filtering the stored water, and introducing it into existing or new water irrigation mains. One example of this stormwater recovery is the UCF Stormwater Reuse System.

A detention pond on the campus of the University of Central Florida was used to demonstrate the construction and operation of a horizontal well. The site was chosen because of its relatively poor soils for infiltration and percolation. Thus, if this detention pond could provide a safe yield of water for irrigation, other similar sites in Florida would also be possible. Water quality data were also reported for this site in chapter four.

5.1 THE UCF STORMWATER REGIONAL IRRIGATION SYSTEM

Researchers demonstrated a wet detention pond on the campus of UCF was used as a regional irrigation system. The watershed for the pond is 155.86 acres. The impervious area is about 74 acres and contains a four lane roadway. The other impervious areas are sidewalks, parking lots, and buildings which are part of a commercial area. The pervious part of the watershed is a combination of sports complex playing fields and highway shoulder areas. The pond area is 15 acres with an average depth of about eight feet at normal pond elevation.

The irrigation water is removed from the pond using a horizontal well. The horizontal well is housed at the university stadium detention pond and is approximately 1000 feet long and about twenty feet deep from land surface. The well is about twelve feet below the normal water level of the pond. Since this was a retrofit, there was no pipe laid under the pond, but instead along the edge of the pond and in a trench about four feet wide. The typical minimum width of trench is eighteen inches. A four feet wide trench was used because the parent soil was very impermeable. A schematic of trench construction details is shown in Figure 7, which illustrates important elevations and distances. The trench was back-filled with sand to provide a more rapid movement of water to the collection pipe. A perforated pipe with a permeable sock cover (usually a two ply filter wrap) was used at the bottom of the trench to collect the water.

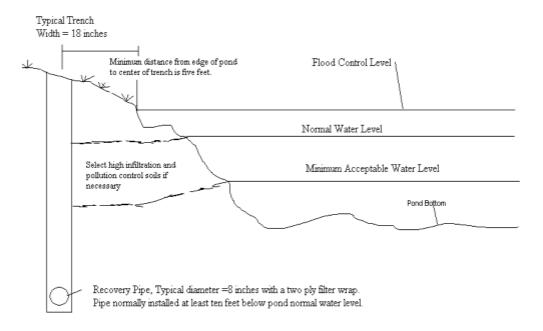


Figure 7: Horizontal Well Construction Details.

To increase the flow of water from the pond into the trenches, highly permeable stringers into the pond were used. These stringers allow preferential flow paths for water in the detention pond to enter the collection system. Perforated pipes were also extended into the detention pond to direct detained water into the trenches, as well as a special filter media for sorption of pollutants. A special filter media is used to enhance the removal of contaminates from the stormwater present in the pond and can be used to enhance stormwater quality with this system in any location. The perforated pipes were then connected to a pump and a subsequent flow rate of over 500 gpm was developed from the horizontal well. This 500 gpm flow rate was the minimum recorded flow rate over a two day period of continuous pumping. The testing lasted over a period of six weeks, pumping continuously for two days each week. The demand for irrigation water is about 77,000 gallons per day for the new UCF stadium and the surrounding grounds. For an eight hour irrigation cycle, the horizontal well can deliver about 240,000 gallons based on a pumping rate of 500 gpm.

At UCF the plan for irrigation is to use the horizontal well in conjunction with reclaimed water. The existing ground water wells would be used only if the stormwater regional detention pond and reclaimed water were discontinued. The detention pond will be the primary source for irrigation water.

Suspended solid samples from the pond water were compared to the Florida DEP reclaimed water standard. The standard for suspended solids is five mg per liter. The detention pond water suspended solids was consistently over that standard (5-9 mg/L). The water did not meet the public access standards for using reclaimed water for irrigation. Since there are no standards for detention pond water used as a source for irrigation, the reclaimed water standards were used.

Water for irrigation was taken from the horizontal well because the water quality was better as measured by turbidity and suspended solids (less that five mg/L in all samples). The stormwater recycling system with the use of the horizontal well consistently produces a water of less than five NTU for turbidity.

This horizontal well filter system can be cleaned and maintained by simply back flushing the perforated pipe; however, from the over 300 locations in operation in Florida to date, there is no need to clean them. It is believed that they can be used on any impounded water body in the State of Florida to provide an alternative water resource for water users, because of past successes and the operational success of the UCF reuse system. Five hundred systems have been installed and there are more than 300 currently in operation in Florida, with the remaining in operation across the USA. This technology was first used in 1987 and introduced within the State of Florida in 1989 (HSSI, 2007). A comparison of a horizontal well to a vertical well is shown in Figure 8 and illustrates a standard section for a horizontal well installation. For the same depth into the surficial aquifer, the horizontal well will remove more water. The length of horizontal well is shown as 500 feet in this case and the depth to the collection pipe is no more than 22 feet. Less deep horizontal wells have also been used provided the depth is below the water table. A four to eight inch diameter pipe is commonly used since larger pipes do not usually provide a proportionally greater flow volume. For most soils, the 500 foot length of a six inch pipe shown can develop between 250-500 gallons of water per minute, depending on soil permeability.

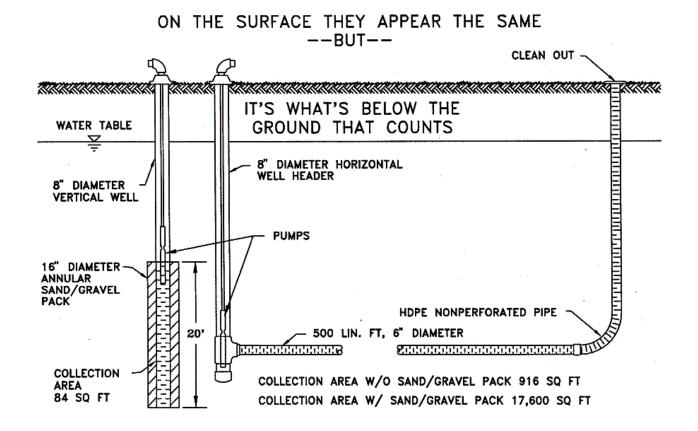


Figure 8: Horizontal Well Section and Comparison to a Vertical Well

5.2 INTELLIGENT CONTROLLER (I2 Controller)

UCF has two horizontal trenches; one each along side of the two stadium ponds. The operating plan is to alternate the selection of the trenches, and if the water level in the detention pond is lower than a preset depth value, to discontinue the use of the horizontal wells for irrigation, instead using the reclaimed source. In addition, the water quality as measured by turbidity will be used to select or to turn off the water from the pond. Pending the approval of the water management district and the state Department of Environmental Protection, the pond can also be refilled using reclaimed water. To carry out the refilling selection, an intelligent controller called I2 will be used. The I2 is a unit that will analyze the water quality properties of

several water sources, as well as the depth of water in the detention pond. This same unit will then enable a water delivery/pumping system to deliver water to a water distribution/irrigation system based on the analysis of the water quality properties. At the UCF site, the particular unit has been configured for the following initial parameters:

THE I2 CONTROLLER PARAMETERS

One Water Source – Stormwater Pond

Two Water Quality Parameters – Pond Level and TSS (future), additional future parameters can be added as required

Two Delivery/Pumping Systems – Pressure Control VFD Pump Controller with a pump alternating control strategy

Distribution/Irrigation System – UCF RainBird Irrigation System

Pond Recharge Source – Reclaim Water

The general operations for the controller to receive a "Water Distribution System Request" are a signal from the water distribution/irrigation system. The distribution/irrigation system chosen is the UCF RainBird Irrigation System. Based on the water quality parameters as compared to the water quality parameter set points, the system will enable a water delivery/pumping system to deliver water from a water source (Stormwater Pond) to the water distribution/irrigation system (UCF RainBird).

There are two water delivery/pumping systems. Only one delivery/pump system shall be activated at a time. The delivery/pumping systems shall be on an alternating pumping scheme. The system shall alternate pumping systems at the end of each pumping cycle or upon a pumping system fault.

When the system is not delivering/pumping water to the distribution/irrigation system and the pond is below an operator adjustable low pond level set point, the stormwater pond shall be re-charged. For re-charging the pond, the system shall use a reclaim water system. This re-

charge cycle shall continue until the stormwater pond is above an operator adjustable high set

point or that there is another request for water from the water distribution system.

When a "Water Distribution System Request" signal is received from the water

distribution system, this system is programmed to enable a water delivery/pumping system

provided the water quality parameters for the water source are acceptable. If the water quality

parameters for water source are not acceptable then the system will not enable a water source.

For a water delivery/pumping system to be enabled all of the following conditions must

be true:

1. "Water System Request"

2. "Water Source Water Level" >= "Water Source Low Level Set Point"

3. "Water Source TSS" <= "Water Source TSS Upper Limit Set Point"

5.2.1 System Specifications

Power Requirements: 120Vac/60Hz

I/O Requirements:

Analog Inputs (4-20mA)

Water Source Level (0-34.6') – Pressure Transducer provided w/Controller

Water Source TSS (0-50 NTU)

Digital Inputs (Relay – Dry Contact)

Water Distribution System Request

Water Delivery System No. 1 Low Level Lockout

Water Delivery System No. 2 Low Level Lockout

Analog Outputs (4-20mA)

N/A

Digital Outputs (Relay – Dry Contact)

Water Source Delivery System No. 1 Enable

Water Source Delivery System No. 2 Enable

Open Pond Re-charge Valve

38

5.2.2 Methodology of Installation:

The I2 Controller consist of an Allen-Bradley MicroLogix 1500, 24Vdc power supply, 120Vac surge suppressor, analog surge suppressors, and other miscellaneous electrical components installed in a 24" x 24" x 8" FRP NEMA 3, 3R, 4, 4X, 12, 13 Hoffman enclosure. The I2 Controller has been assembled by a UL 508 panel shop and bears the UL mark of such.

The controller shall be mounted on a rack or stand and installed per NEC and local electrical code requirements. In no way shall any penetration into the controller affect the NEMA rating of the controller. The controller shall be installed in such a way as to limit the temperature inside the enclosure to 110 F. For example, if the controller is to be installed outdoors, sun shields shall be provided by the contractor to protect the controller and to assist with keeping the controller at an acceptable temperature.

The controller has been provided with one pressure transducer to be used for water source level. This pressure transducer is to be installed by the contractor in the water source and wired back to the controller. The contractor shall provide everything necessary (labor, tools, material, and required equipment) to install the pressure transducer and to get the signal from the transducer to the controller.

The controller has an input to be used to indicate to the controller that the water distribution system requires water. The contractor shall provide this signal from the water distribution system to the controller. The contractor shall provide everything necessary (labor, tools, material, and required equipment) to provide this signal and get the signal from the water distribution system to the controller.

The controller will be been provided with two outputs. Each output shall be used to enable a water delivery system to deliver water from the water source to the water distribution

system. The contractor shall provide everything necessary (labor, tools, material, and required equipment) to provide these signals from the controller to the water delivery systems.

The controller will be provided with an output to open a valve to re-charge the pond from a reclaim water source. The contractor shall provide everything necessary (labor, tools, material, and required equipment) to provide this signal from the controller to the pond re-charge valve.

The controller will be provided with additional inputs to monitor the low level cut- off status of the water delivery systems. The contractor shall provide everything necessary (labor, tools, material, and required equipment) to provide these signals from the controller to the water delivery systems.

The I2 Controller will be programmed and configured based on known water quality parameters. Modification to the program and configuration may be made in the field after installation is complete.

A representative from the I2 Controller team will be available to review the installation requirements with the contractor before the installation begins and will also be available to inspect the installation once the installation is complete.

In addition, a representative from the I2 Controller team will be available to assist with start-up and checkout of the system once the system is ready for operation.

CHAPTER 6 – CONCLUSION AND RECOMMENDATIONS

6.1 Summary

Fourteen stormwater ponds located in central Florida were sampled for Cyanobacteria total and potentially toxic (PTOX) counts and toxin concentrations. These ponds had visual appearances of Cyanobacteria, and in some ponds, Orange County Environmental Protection had identified at least the qualitative assessment of the Cyanobacteria. For two stormwater ponds, Lake Terrier and Lake Condel, there were confirmed Cyanobacteria counts. The additional stormwater ponds were chosen to represent different land uses, such as urban roads, state roads, institutional, residential and industrial. The ponds were sampled on two different occasions for the documentation of Cyanobacteria counts and toxin concentrations.

Even though Cyanobacteria were found in all of the ponds evaluated for this study, one particular location, or watershed source, did not show a greater concentration of Cyanobacteria over any other. The average counts for the stormwater ponds were 1,893 total and 470 PTOX in April 2005 with standard deviations of 3,113 and 724 respectively. For the August 2005 sampling, the average counts were 11,093 total and 4,896 PTOX with standard deviations of 11,924 and 6,371 respectively. Lake data shown total count numbers ranging from 116,700 to 1,361,860, and PTOX counts as high as 154,190.

In addition, four soil columns were used to infiltrate and percolate stormwater pond water. Pond water from three ponds along S.R. 417, Lake Condel, and Pegasus pond were

applied to the columns to simulate a year of water. The columns were four feet deep and sampling occurred at this depth to detect the occurrence of Cyanobacteria counts and toxin concentrations. The columns were two foot square and filled with the most common sandy soils on the campus of UCF. The soils were poorly graded and classified as type- A hydrologic in terms of their drainage characteristics and were compacted to 92% density to simulate construction practices.

The fourteen ponds were surveyed for area and depth, which provided an estimate of the as-built and operational conditions. The volume of each pond was then calculated. Geometric data for pond sizes were not available, thus field reconnaissance for pond depths and the use of aerial maps for pond area estimation had to be obtained. This resulted in more accurate pond volume estimates relative to the use of planned construction drawings.

6.2 Conclusions

The results of this research show that total and PTOX Cyanobacteria counts and the toxins associated with them do exist in stormwater ponds across the central Florida area. This was the first documentation of such numbers and as such had no other comparative pond data; however, the total counts are much lower in the stormwater regional ponds by about two orders of magnitude, relative to those counts found in large central Florida lakes.

Assuming that relatively low levels of Cyanobacteria tend to be found in stormwater ponds, the filtration mechanism of natural soil material appears to be an effective means of reducing the total Cyanobacteria counts and the potentially toxic Cyanobacteria counts as well. There were no Microcystin toxins after filtration that exceeded the World Health Organization drinking water standard of one ug/L. The Microcystin toxins are produced from the

Cyanobacteria and were shown to be significantly reduced by the natural soil media; however, the toxin concentrations in the waters of the stormwater ponds did exceed one ug/L in seven percent of the samples.

The area and depth of each stormwater pond was evaluated and the volume of each was estimated. Larger volume and area lakes have higher Cyanobacteria counts and thus larger ponds may have higher counts. The data from this study, however, showed no statistical relationship for counts or toxin concentrations to the volume of stormwater ponds, presumably because of the proportionate amount of rooted vegetation in each pond which help remove nutrients from the water column.

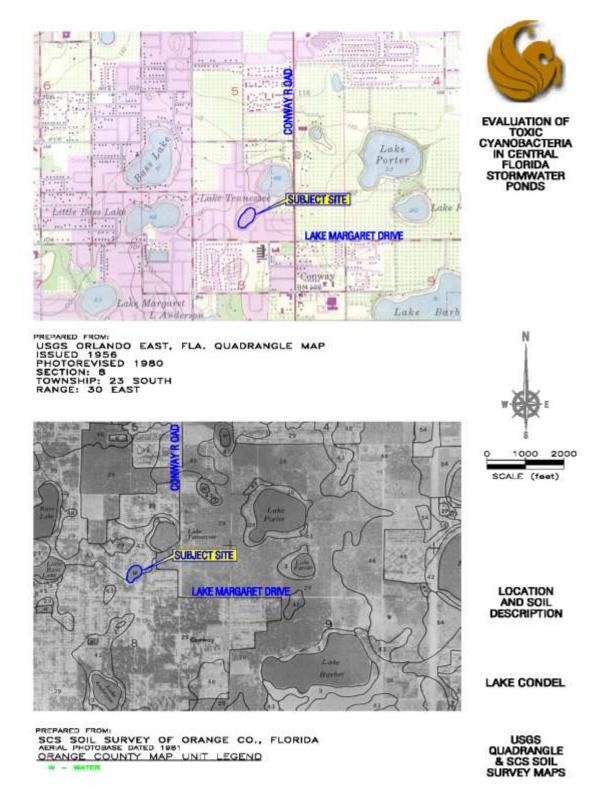
6.3 Recommendations

The results of this study conclude that stormwater ponds should be treated the same as lakes in the area relative to any regulations regarding the beneficial uses of water from lakes and ponds. This conclusion is based on site location and climate condition requirements for this study, and is based on the Cyanobacteria data of this study.

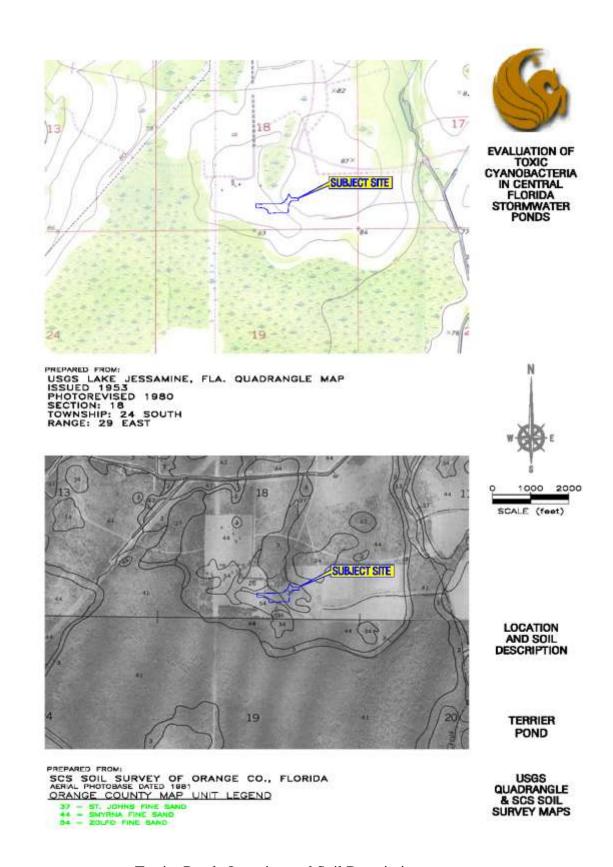
There were significant removal of total and PTOX Cyanobacteria using naturally occurring, poorly graded soils. However, further study is necessary for the removal of toxins in stormwater using these and other naturally occurring soils. Some evidence shows that additional organic content may reduce the toxins and will be examined in a continuing study, adding more definitive data on the forces causing removals. The growth rate as related to residence time may as well be important and worthy of additional research, because of the lower residence time in the stormwater ponds relative to the large lakes.

The use of regional stormwater ponds with horizontal wells should be considered to meet stormwater pollution control standards and to help reduce dependency on potable water for irrigation supply. Construction details for horizontal wells are shown in Figure 7 and are recommended for use with established ponds. Stringers about four feet wide and placed about every fifty feet along the pond edge are recommended to enhance the follow of water from the pond to the trench.

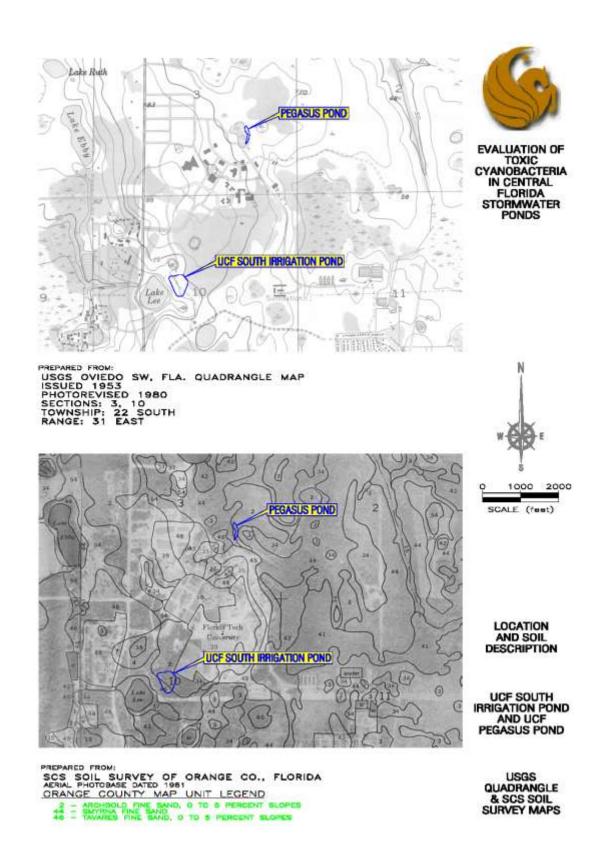
APPENDIX A: USGS QUADRANGLE and SCS SOIL SURVEY MAPS



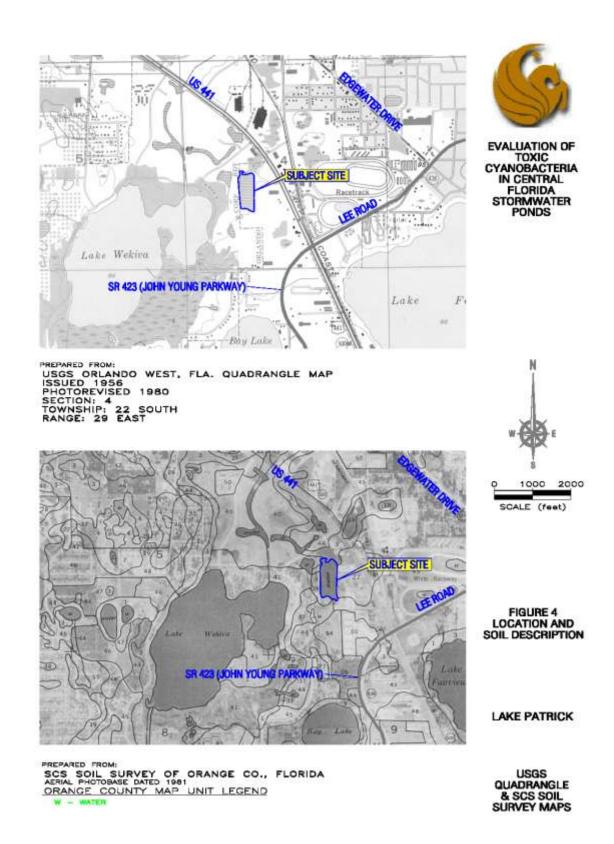
Lake Condel: Location and Soil Description



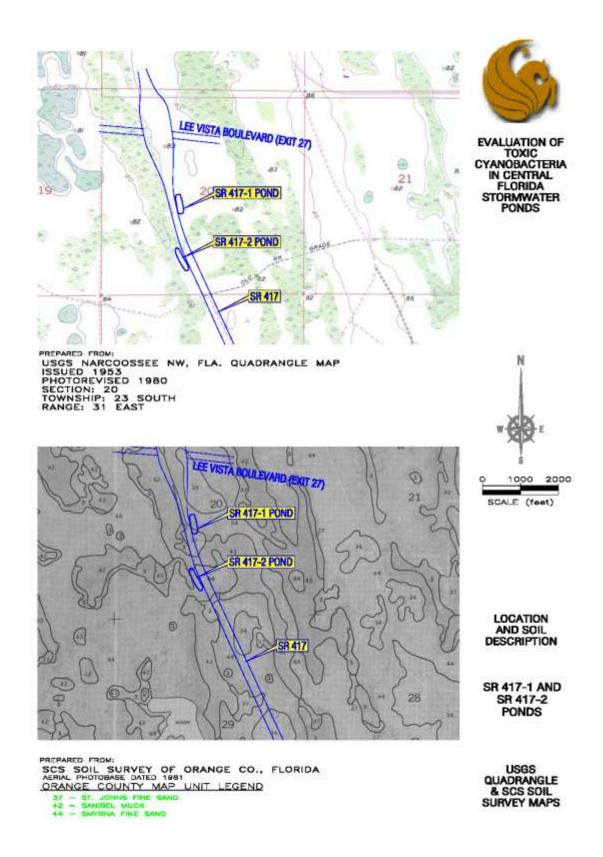
Terrier Pond: Location and Soil Description



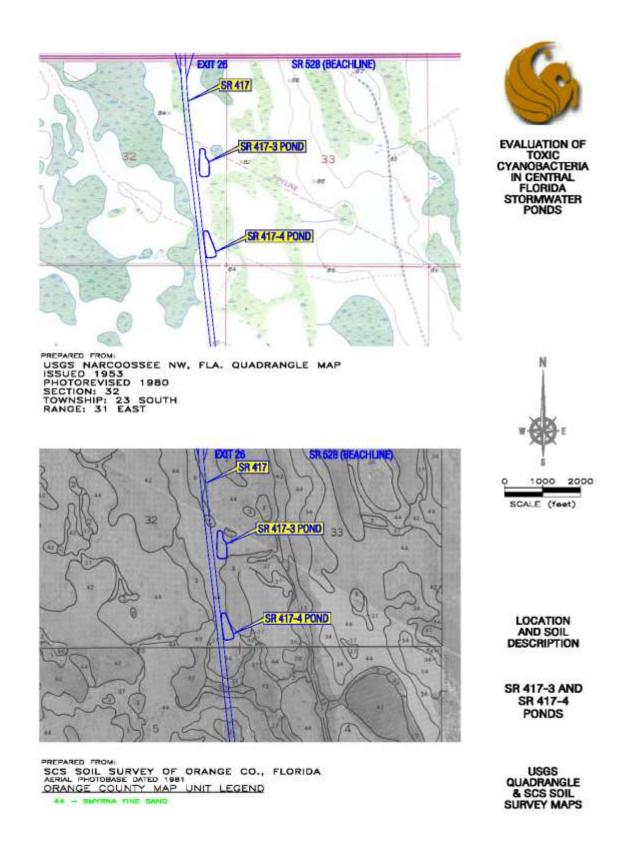
UCF South Irrigation and Pegasus Ponds: Location and Soil Description



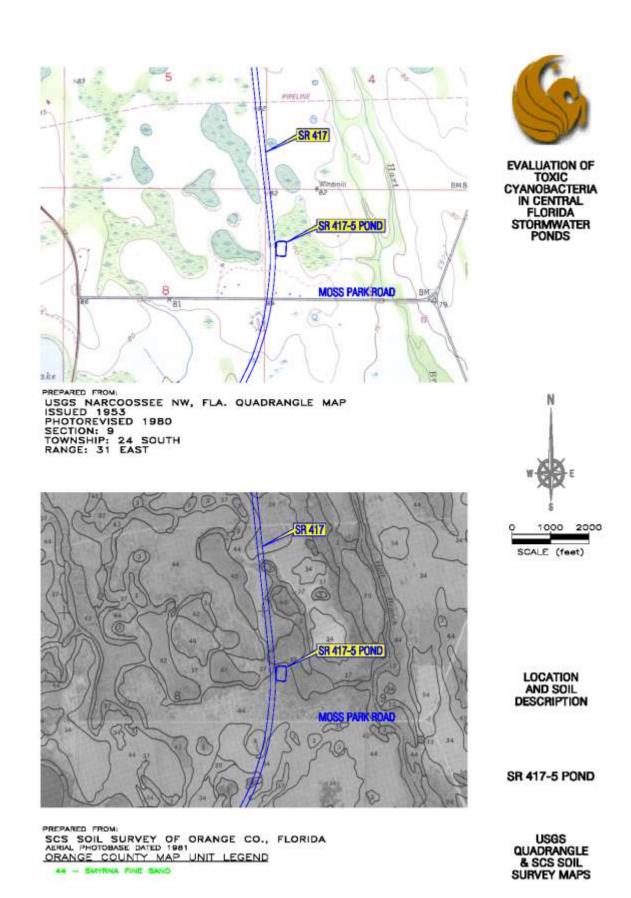
Lake Patrik: Location and Soil Description



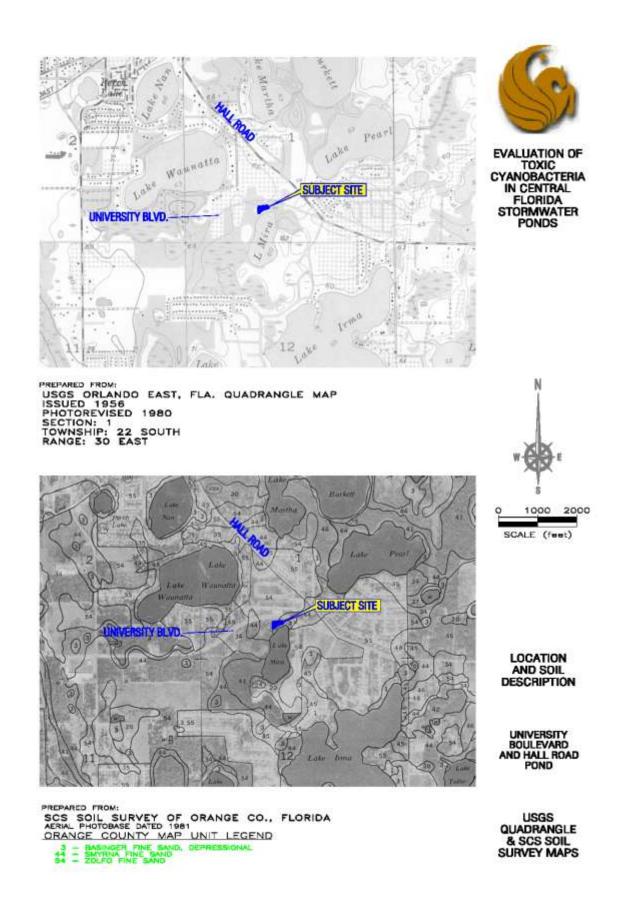
S.R. 417-1 and S.R. 417-2 Ponds: Location and Soil Description



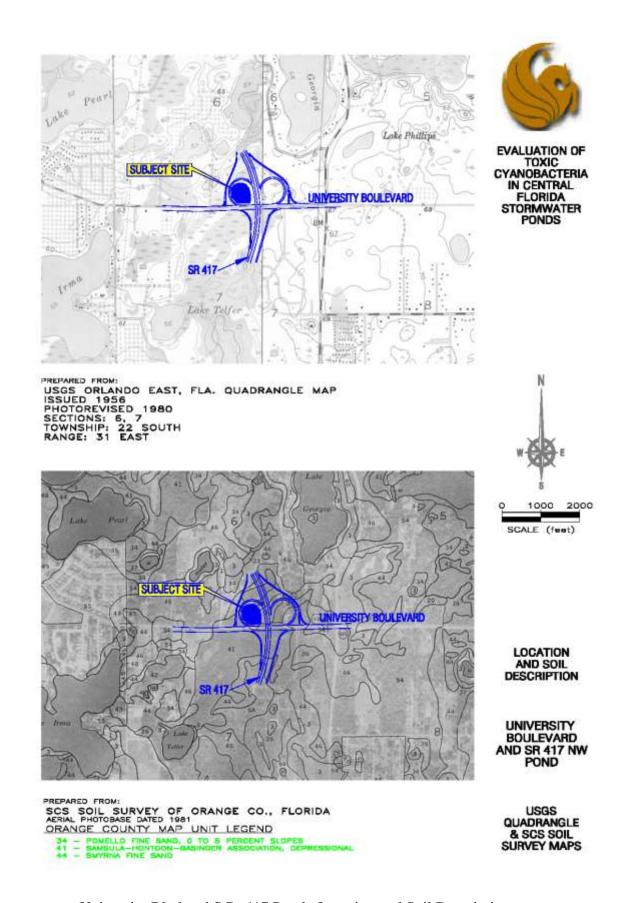
S.R. 417-3 and S.R. 417-4 Ponds: Location and Soil Description



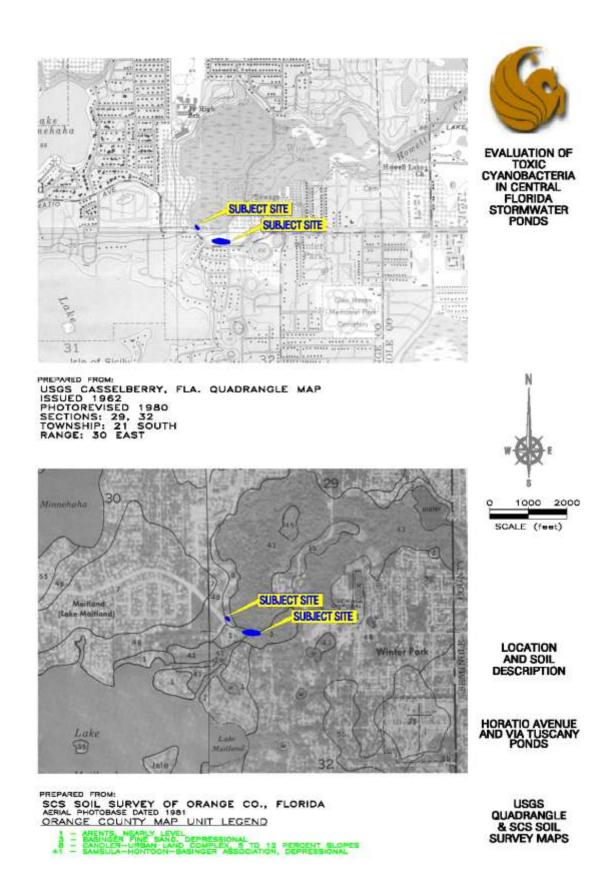
S.R. 417-5 Pond: Location and Soil Description



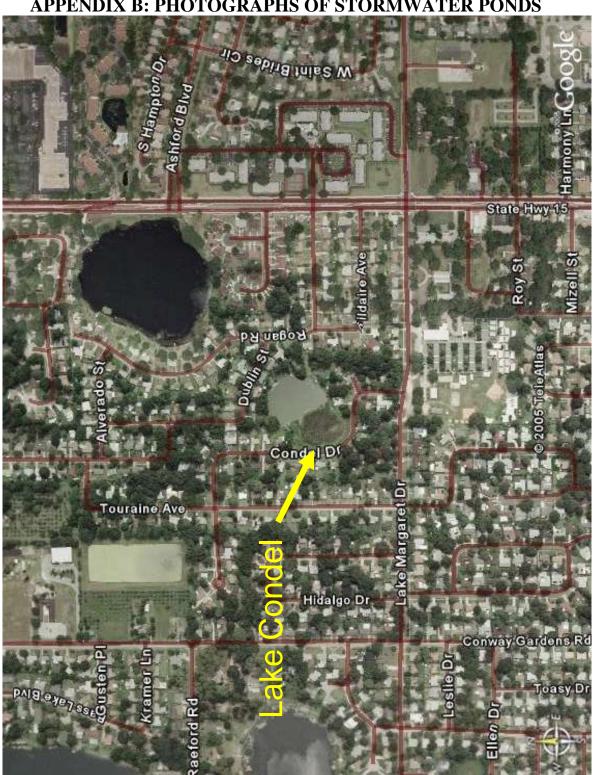
University Blvd and Hall Road Pond: Location and Soil Description



University Blvd and S.R. 417 Pond: Location and Soil Description



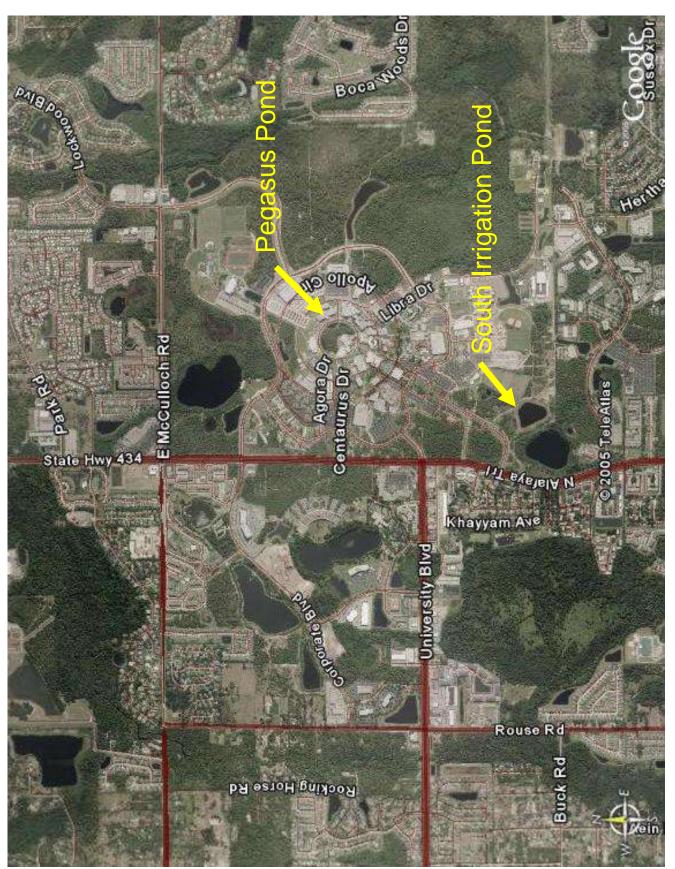
Horatio Avenue and Via Tuscany No. 1 and No. 2 Ponds: Location and Soil Description



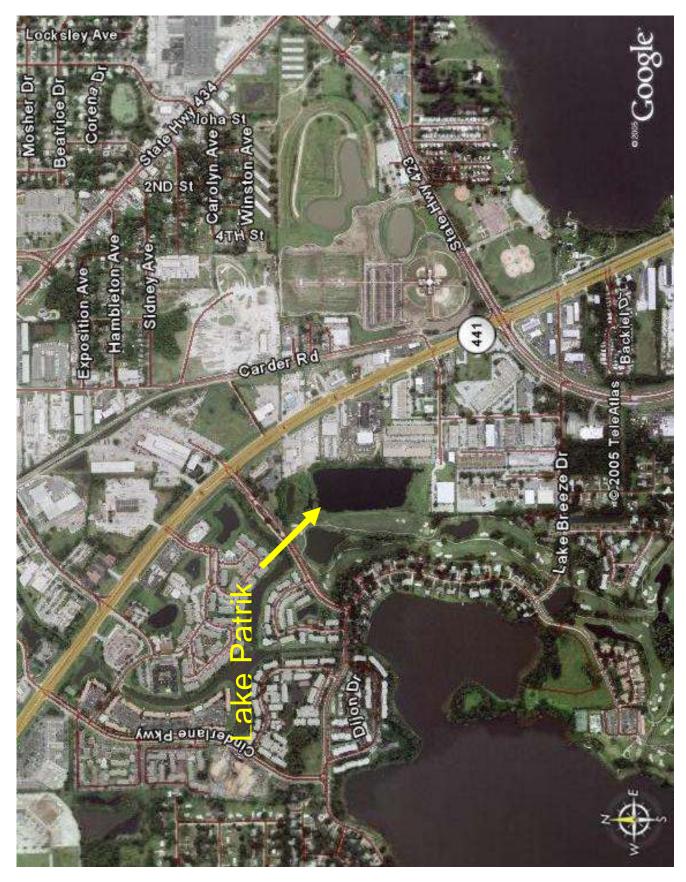
APPENDIX B: PHOTOGRAPHS OF STORMWATER PONDS

Lake Condel: Aerial photograph of subject site and surrounding area.

Terrier Pond: Aerial photograph of subject site and surrounding area.



UCF South Irrigation and Pegasus Ponds: Aerial photograph of subject sites and surrounding areas.



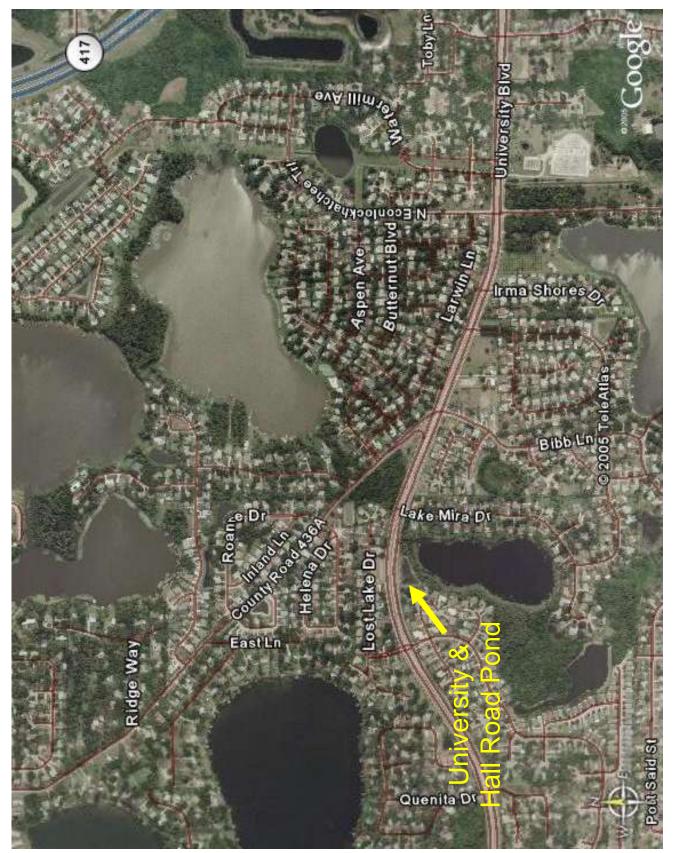


S.R. 417-1 and S.R. 417-2 Ponds: Aerial photograph of subject sites and surrounding areas.

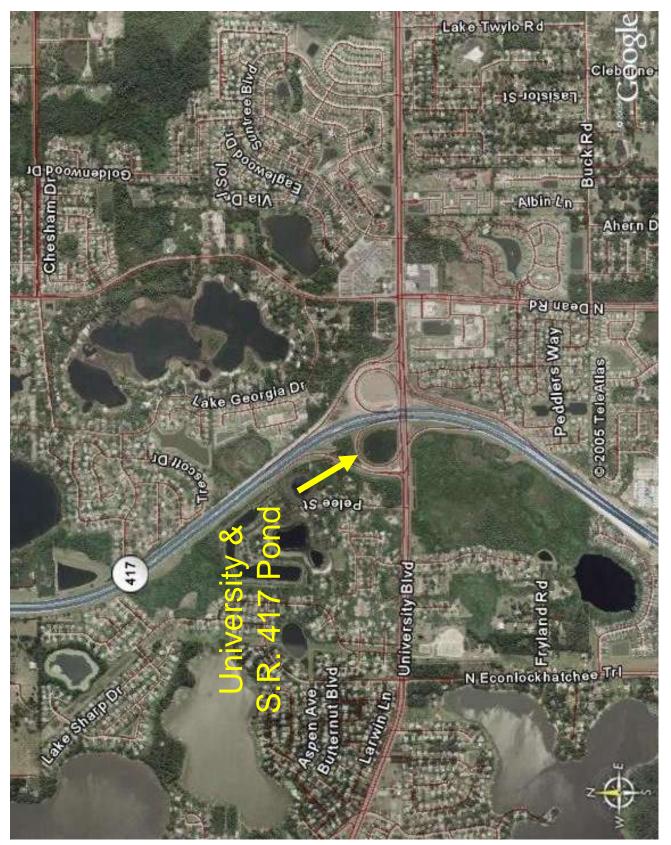


S.R. 417-3 and S.R. 417-4 Ponds: Aerial photograph of subject sites and surrounding areas.

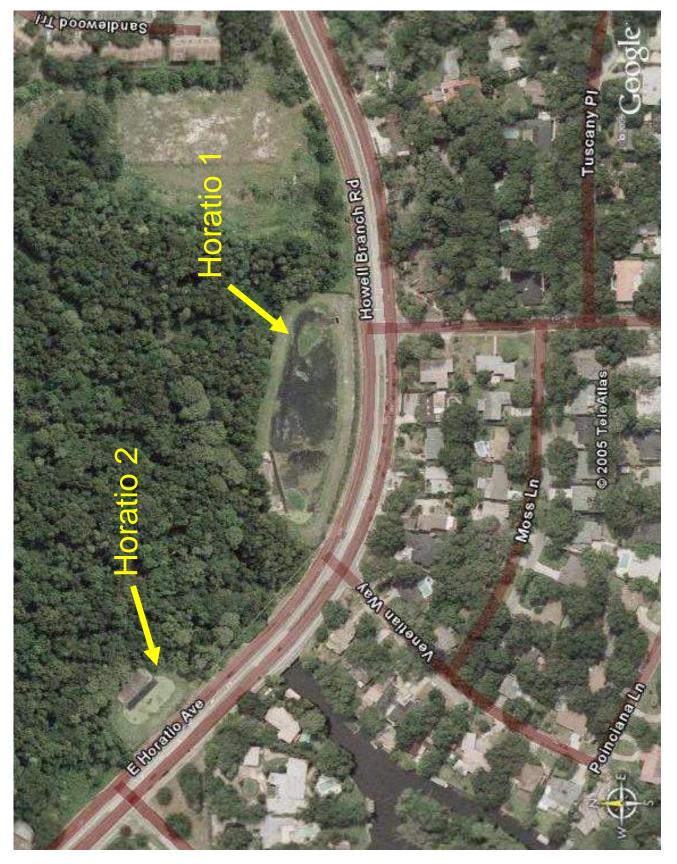
S.R. 417-5 Pond: Aerial photograph of subject site and surrounding area.



University Blvd and Hall Road Pond: Aerial photograph of subject site and surrounding area.



University Blvd and S.R. 417 Pond: Aerial photograph of subject site and surrounding area.



Horatio Avenue and Via Tuscany Ponds: Aerial photograph of subject sites and surrounding areas.



Lake Condel: View of the south shoreline from the west shore.



Lake Condel: View of the east shoreline from the west shore.



Terrier Pond: View facing west from the east shore (standing at the nose of the dog).



Terrier Pond: View from south shoreline facing west.



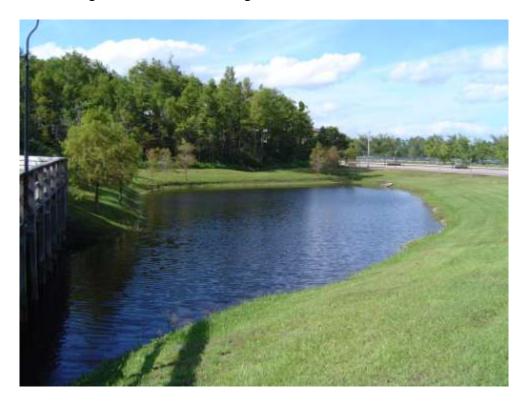
UCF South Irrigation Pond: View facing south from the north shore.



UCF South Irrigation Pond: View from south shoreline facing northeast.



UCF Pegasus Pond: View facing southeast from the northwest corner.



UCF Pegasus Pond: View from east shoreline facing northwest.



Lake Patrik: View facing northeast from the south shoreline.



Lake Patrik: View from southeast corner facing northwest.



S.R. 417-1 Pond: View of north shoreline.



S.R. 417-1 Pond: Close up view of algae along north shoreline.



S.R. 417-2 Pond: View from south shoreline.



S.R. 417-2 Pond: View of east shoreline.



S.R. 417-3 Pond: View of west shoreline.



S.R. 417-3 Pond: View of northwest corner near Beachline (S.R. 528) exit.



S.R. 417-4 Pond: View from southwest corner.



S.R. 417-4 Pond: View from northwest corner facing southeast.



S.R. 417-5 Pond: View from southwest corner.



S.R. 417-5 Pond: View of algae along north shoreline.



University Blvd and Hall Road Pond: View from northwest corner.



University Blvd and Hall Road Pond: View from southwest corner.



University Blvd and S.R. 417 Pond: View from southeast corner facing west.



University Blvd and S.R. 417 Pond: View from southeast corner facing north.



Horatio Avenue and Via Tuscany No. 1: View from east shoreline.



Horatio Avenue and Via Tuscany No. 1: View from southeast corner.



Horatio Avenue and Via Tuscany No. 2: View from southwest corner.



Horatio Avenue and Via Tuscany No. 2: View from southeast corner.

APPENDIX C: GREENWATER LABORATORIES SAMPLING DATA



aquatic analysis ... research ... consulting

Microcystin Data Report Project: UCF Stormwater Management Academy

Sample Identification	Sample Collection Date
1. Chamber 1 filtrate	050415
2. Chamber 2	050415
3. Chamber 3	050415
4. Hall Rd. East	050417
5. UCF South Pond	050417
6. Lake Patric	050417
7. Lake Condel South	050417
8. Terrier Pond East	050417
9. Terrier Pond South	050417
10. Student Union	050417
11. 417-1 South	050417
12. 417-2 North	050417
13. 417-3 South	050417
14. 417-4 South	050417
15, 417-5 South	050417
16. 417 Univ. NW	050417
17. Horatio 1 @ Weir	050417
18. Horatio 2 @ Weir	050417

 $\frac{Sample\ Prep}{Sample\ Sample\ Section 1.0\ \mu g/L\ of\ microcystin-LR\ as\ well\ as\ a\ 1.0\ \mu g/L\ microcystin-LR\ standard\ sample\ were\ utilized\ for\ additional\ quantitative\ purposes\ (recoveries/correction\ factors).}$

<u>Analytical Methodology</u> – An Enzyme Linked Immunosorbent Assay (ELISA) kit (expiration 12/05) was utilized for the determination of the concentration of **total** microcystins present. Each sample (including spikes) was run in duplicate.

Limit of Detection/Quantification = 0.04 µg/L (0.04 ppb)

Cyano

209 Zeiger Drive, Suite 302 - Palatka, FL 22777 Info@greenwatterlati.com + www.greenwaterlati.com 286.328.0882 veius + 386.328.9646 für syanomäi@syanolub.com + www.syanolub.com

UCF Microcystin Results
Sampled on 415/2005 and 417/2005

Sample ID	Assay Value, ug/L	Dilution Ratio	Final Conc. Factor	Std. Recovery	Corrected Spike Recovery (%)	Final Corrected Concentration (ug/L)	Average (ug/L)	Standard Deviation
Charmber 1 filtrate	0.10	none	lx	74	78	0.17	0.13	0.06
	0.05	none	lx	74	78	0.09		
Chamber 2	0.12	попе	1x	83	89	0.16	0.18	0.02
	0.14	попи	1x	83	89	0.19		
Chamber 3	0.28	none	1x	83	89	0.38	0.39	0.01
	0.29	none	1x	83	89	0.39		
Hall Rd East	0.10	none	1x	98	66	0.15	0.18	0.04
	0.13	none	1x	98	66	0.20		
UCF South Pond	0.24	none	1x	74	73	0.44	0.49	0.07
	0.29	none	1x	74	73	0.54		
Lake Patric	0.08	none	tx	74	77	0.14	0.16	0.03
	0.10	none	1x	74	77	0.18		
Lake Condel South	0.12	none	Ix	98	81	0.15	0.17	0.02
	0.14	none	1x	98	81	0.18		
Terrier Pond East	0.09	none	1x	90	92	0.11	0.10	0.02
	0.07	none	1x	90	92	0.08		
Terrier Pond South	0.05	none	lx	90	92	0.06	0.10	0.05
	0.11	none	1x	90	92	0.13		
Student Union	0.11	none	1x	98	80	0.14	0.16	0.02
	0.13	none	1x	98	80	0.17	100000	2355
417-1 South	0.36	none	lx	90	92	0.43	0.38	0.07
	0.27	none	Ix	90	92	0.33		
417-2 North	0.49	none	1x	98	80	0.62	0.60	0.04
	0.45	none	1x	98	80	0.57		
417-3 South	0.10	none	1x	98	93	0.11	0.13	0.03
	0.14	none	1x	98	93	0.15		
417-4 South	0.14	none	1x	98	72	0.20	0.20	0.00
	0.14	none	tx	98	72	0.20		
417-5 South	0.17	none	1x	98	97	0.18	0.19	0.01
	0.19	none	1x	98	97	0.20	527724	5555
417 Univ. NW	0.09	none	1x	98	78	0.12	0.14	0.03
	0.12	попе	ix	98	78	0.16	35515	(9)3/6
Horatio 1 @ Weir	0.06	none	1x	90	87	0.08	0.09	0.01
	0.07	none	1x	90	87	0.09	(1)505538	7.00
Horatio 2 @ Weir	0.12	none	1x	90	93	0.14	0.19	0.06
The second secon	0.19	none	Lx	90	93	0.23	0.87570	2000

Sample Description	Sampling Date Genue	Genus	Species	Algal Group	(units)	Algal Group # Counted Counting Unit Magn (units)	Magn	Field Area (mm2)	of Fields	Setting Vol. (ml.)	Field Area # of Fields Setting Vol. Dilution Factor (mm2) (mt.)	Species	Species CYANOTotal Plox CYANO Unitsim, Unitsim, Unitsim,	A CYANO Julishmic
1. Charber Lightee	050415	cyanophyte haned	10.01	CVANO	-	Named.	400	0.0625	7.0	L	-	800	1,167	0
1 Chariber 1 Fibrais		cyanophytefliament		CICANO	10	figurest	400	0.0625	10	-	-	100		
1. Chamber 15 fmbe		cyctophyte	to (ChifSun)	14,65	36	75	100	0.0825	7.0	-	**			
1. Chamber 1Fitnite	050415	ancel, oralind 255am			×	B	89	0.0025	10	-	-			
1. Chamber 19ftste		uncel, sphere 255km	021		*	E	400	0.0625	70	+-				
1 Chamber 1 Fibrati		uncel, sphere 5,75sm	300		i.	100	200	0.25	30	-				
2 Chamber 2	l	pyanopyte pasent	Г	CVANO	×	framed	400	929010	10	-	4	88	130	0
2 Chamber 2		Nezsche	up G=15am	BACIL	-	18	904	0.0005	20	_	_			
2 Chamber 2		Centrals distant	e T	BAOL	-	8	9	0.0805	7.0	-	-			
2 Chamber 2		cyctophyta	: 17	CRIMIT	-	160	400	0.0625	10	**	-			
2 Chamber 2	050415	cyptophyte	sp (Chriffun)	TH/H	*	16	200	0.38	30	-				
2 Chamber 2		uncel ovelited 255sm	3DD		*	18	400	0.0625	120	-	-			
2 Chamber 2		ancel, gitere 25-5µm	100		ж	18	89	0.0005	70		-			
2 Chariter 2		uncel sphere 575gm	025		æ	8	400	0.0005	70	-				
3 Chamber 3	l	cyanophyte chan	10.01	CYANO	-	Married	200	0.28	30	-	-	38	751	100
3 Chamber 2	050415	cyanophytoliament		CYANO	o	Normal	400	0.00055	70	_	-	2000		
3 Chamber 3		cyanophyte hismant		CYANO	re	figment	400	0.0005	7.0	-		130		
3 Chamber 3		united ovaling 25-5um	300		*	160	400	0.0805	10		-			
	l	Agrianocipse	Stb <0m	CYANG	ŀ	Autogo	400	0.0005	20	-	-	5	380	0
4 Hall Fid East		cyanophyte filment	ED (2)	CYANO	-	frament	200	920	30	-	-	8		
4 Hall Rd East		cyanophite flament	50 Cit	CYANO		- Kennest	400	0.0005	90	-	-	5		
4 Hull Rd East	050417	Cymithya	3	CYANO	-	Transet.	8	285 553	-	-	-	-		
a Hall Rd East		Oscilianos	0	CYANO	24	Stanset.	90	283.53	300	-	-	24		
A Hull Rid Emit		oscilitorar flament	E 45	CYANO	c	flament	400	0.0625	90	_	_	00		
4 Hall Rid East		Semante duman	sp. (L=10am)	BACIL	×	8	400	0.0005	20	÷	**			
4 Half Rd East		permane durion	sp (L=20um)	9401	×	18	000	920	90	+	_			
4 Hall Rd East		chiprophyla Rament	SD (B)	CHICA	×	Namen	900	920	- 20	-	-			
4 Hall Rd East		Countries	at (large)	CHLOR	×	190	007	0.25	90	-	-			
4 Hall Rd East		Cosmanus	sp. (med)	ONCR	×	8	400	0.0625	20	-				
4 Hall Rd East	050417	Eutetranons	10 (11	OHOR	96	calany	400	0.0625	30	4	-			
A Hall Rid Eint		Mougedta	di	80%	×	fament	8	26852	-	-	-			
4 Hall Rd East		000/985	担日	SH SH	×	Autopoo	400	0.0625	90	-	-			
4 Hall Rid East		Occusts	SD (4)	8 H	×	colony	900	0.26	20					
4 Hall Rid Elen		Scanedarmus	othens	SHOR	×	coony	400	0.0625	30	_	_			
4. Hull Rid East		Sconedastrus	di di	CHLCR	×	colony	9	0.0625	20	-	-			
4 Hull Rd East		Sproges	99	DALOR	×	Yearout	90	216 53	_	**	_			
4 HalfRd East		Starratham	50 Carps	CHOR	in	B	20	266.53	8-	-				
4 Hall Rid Emit	050417	Samstam	::0	OHLOR	×	16	200	100	30	+	-			
4 Hall Rd East		chotophyte	H	CRIME	×	18	200	920	20	-	_			
4. Hall Rid East		cyctophyte	a	CRYPY	×	190	400	0.0625	- 20	_	gar.			
4 Hall Rid Elect	050417	cyctophyte	at	CRIPT	×	8	400	870078	90	-	***			
4. Halfid Emt		uncell, ordiffod 25,5µm	dfs		×	H	904	0.0625	S	-	_			
4 Hall Rd East	Pro-	ancel, sphere 25-5em	£		×	芳	8	0.0025	20	**	-			
4 Hall Rd East		uncel sphere 575sm	410		×	B	400	0.0825	20	1	2			

GreenWater Luborationes Sergaing Data April 2005

- 5	Sample Description	Sampling Date Genus	Genus	Species	Algal Group	(units)	Algal Group & Counted Counting Unit Magn Field Aves & of Fields: Setting Vol. Dilution Factor (units) (mil.)	Magn	Field Area (mm2)	# of Fleids	Setting Vol.	Dilution Factor	Species Unitalia	CYAND Total Plex CYAND L Unitsimi. Unitsimi.	Yex CYAND UnitsimL
Page 1			Aphanocopta	IIIp. chm	CYANO	9	. Auggo	900	0.0625	R		-	162		0
107			cyanophyteflament	10 fb	CYANO	-	Stanier	8	0.0625	20	~		Si		
MY	UCF South Pond		UmothrxPostdatabene	ū	CYANO	-	Sament	100	269.53	-	c	-	-		
40	UCF South Pond		Materiopeda	punctifia	CYANO	-	colony	300	92	8	2	-	10		
40	UCF South Pond		Osciliania	10.03	CYANO	-	figner	200	0.25	8	r	-	0		
H	UCF South Posts		esolistorian figurent	世録	CYANO	474	Saner	400	0.0825	10	ex		19		
H	UCF South Poed		Nartula	10 G=25sm	BACIL	100	18	400	0.0825	E.	***	-			
40	UCF Soun Pond		permade dartom	SD 02-30 pm	BACIL	ж	8	400	0.0625	20	ce				
90	UCF South Pond		Specta	ED 0.=50 pm	BACIL	×	8	900	500	R	~	-			
10	UCF South Pond		chlorophyte colony	(i) (i)	CHOR	×	colony	400	0.0005	20	-	-			
417	UCF South Pend		chlorophyte angle cell	E 19	CHCO	×	18	400	0.0625	g	(4	-			
M	UCF South Point		chiorophyte tebas	E 98	OHOR	×	Augoo	300	570	R	- 7	-			
47	UCF South Pond		Costerun	autum var variable	ORCH	×	79	907	0.0625	D.		-			
*0	UCF South Pond		Coelegium	B)(II	OHUGH	×	Autopoo	900	283.53	-	n				
47	UCF South Pond		Didymocystis	fitte	SHUR	н	coluny	400	0.0625	20	7	-			
10	UCF South Pond		Elakatotriis	vrids	OKCR	×	colory	400	0.00025	R	2	-			
87	UCF South Pond		Eudorna	II) dt	DALCR	-	colony	400	0.0025	R	e	-			
47	UCF South Pond		Eutheramonus	E 9	90,40R	ini	Autopo	400	0.0025	R	**	-			
40	UCF South Pond		Opcydas	12.0	ONLOR	×	colony	909	0.0625	2	es	-			
40	UCF South Point		Oppyritis	0.00	0400	-	colony	400	0.0625	20	è	-			
40	UCF South Pond		Scanadesmus	gastroada	OHOR	*	colory	100	250.53	-	***				
10	UCF South Poted		Staurastrum	tap derged	00408	н	poo	300	0.00	8	0				
40	UCF South Postd		Standstath	to oned	OKOR	×	900	900	0.0625	2	118				
M	UCF South Pond		Disobyon	9	OFFYS	-	colony	901	289.53		es				
10	UCF South Pond		cryptophyte	to (Distant)	CRYPT	-	ON	900	0.0635	96	14	-			
10	UCF South Pand		cryptophyta	10. C=10,mi	CRYPT	~	E	400	0.0625	70	C	-			
W	UCF South Pond	050417	snicel, evalved 25-5am	100		-	po	400	0.0025	100	**	-			
40	UCF South Pond		uncell sphere 255um	O.T.		×	臣	400	0.0605	R	ė.	-			
10	UCE South Pond		unicel sphere 5.75um	000		ja	cod	400	0.0625	200	c	-			

- 1	Sample Description	Sampling Date Genue	Genue	Species	Algal Group	(units)	Algal Group & Counted Counting Unit Magn (units)	- 1	Field Area (mm2)	F of Fields	Setting Vol.	Field Area & of Fields Setting Vol. Dilution Factor (ms); (ms)	Species Units/ml.	S S	tex CYAND UnitsimL
φ	Lake Patrick		Anabaena	circinalia/flos-aquae (1)	CYANO		Sameri.	100	283.53	1	cu		-	295	390
440	Lake Patrick		Anabsera	7	CYANO	ŭ	Samont	900	90300	P	en	-	380		
-	Lake Patrolic		Aghanocapas/Chrococcas	û	CYANO		colon/	400	0.0625	2	~	-	S		
-	LakePandi		cyanophyle chem	10 00	CYANO	-	figrater	400	0.0005	R			22		
m	LakePando	100	ovanophiteflianer	10 (3)	CYANO		figreet	200	900	8	r	-	0		
-	LakePandi	090417	Urmotht/Psydanthena	130	CYANO	-	Namen	400	0.0625	200	e	-	23		
100	Care Partor	763	osollatoran Trament	10 (1)	CYANG		Stanent	200	0.55	80	r.	-	ģi.		
40	LakePatrick		Plankolmgtvin	ct lemetra	CYANO	-	Named	400	0.0625	22	ee	-	SI		
10	(ake Pamok		Autamosera	traica	BACIL	×	chan	100	288.53	-	~	-			
40	Lake Patriol		Nanole	30 G=29smi	8401	×	18	98	0.25	8	-	-			
10	Lake Paridi.	turi.	NESche	ap 0.=20sml	BACIL	×	15	400	0.0625	g	(4	-			
40	LassPande		pernate diatom	sp. 0.=12um	BACIL	×	180	400	0.0625	20	-	-			
90	Lake Parid		perhate dators		BACIL	×	199	907	0.0605	02	-	-			
10	Lake Patrick		Bothypoorcos	- 75	OHEOR	×	colony	100	268.53	-	PH				
-	LisePando		characterist colony		OHOR	н	colony	400	0.0625	30	-	-			
10	Lake Partick		chicrophyle colony	100 10	O# CR	×	colony	400	0.0005	20	0	-			
- 40	Sale Plands		Chranotyte ande cel	ie a	DALCR	-	明	400	0.0025	R	e				
10	Lake Paprids		Closhrum	action or carable	BO340		95	100	200.53	-	**	-			
40	LakePublick		Chillerian	E) (II	ONLOR	*	lat.	93	283.53	+	e	-			
-	Lake Patrolic		Dictrosphannum	ā	0000	×	colony	9	0.0605	200	***	-			
100	Lake Potnide		Eutotramonis	10.00	ONLOR	*	victory	400	0.0625	20	**				
40	Lake Patrick		Francisia	50 9	0408	H	100	9	266.53	-		-			
10	Lake Plantsk		Monocaphidan	arcustom	OKOR	×	100	R	0.38	8	178				
10	LakePandi		Moraphidum	10.00	90,00	-	800	907	0.0625	70	n				
WO.	LanPandi		Mosoraphidum/folidia	9	POLOR	4	280	900	0.0825	200		-			
-	LakePandi		Occyds	(5) B	90408	*	colony	400	0.0625	700	2	-			
10	Lake Patrids		Pandonna	monum	9409	*	colony	400	0.0625	20	*	-			
40	Laka Patride		Staurastrum	up. Garped	OHCOR OHCOR	*	To To	300	97.0	R	4	-			
10	Lake Pamidi		cyptophyte		CRYPT	×	160	400	0.0625	100	c				
100	LakePando		cryptophyta	sp 0.=15smi	CRYPT	×	18	200	0.00	8	rs.	-			
100	LSkePandi		cyptophyte	Ħ	CRYPT	×	35	400	0.0625	70	2				
10	Lake Patrick		Ceratium	hrundinelis	CINDP	×	18	8	0.38	8	2				
-	Lake Patrick		Centrifractus	Û	XANTH	×	8	9	0.0625	20	7				
10	Løler Patrick	050417	uncell sphere 25-5um	025		(H)	18	400	0.0625	20	2	-			
40	DURG NES		uniced sphere 5.7 form	925		H	Cold	400	0.0605	200	e	-			

CYAND Total Plox CYAND
L Unitsimi, Unitsimi,
12.590 227 **★左**星公園-原在 Dilution Factor Setting Vol. 1 (mt.) Field Aires # of Fields # Counted Counting Unit Algal Group Helpera Berschum up (med) caddum sp. (1) by cellum up (D-8um) up (D-8um) up (D-8um) Genue Sampling Date

General/later Laboratories Sampling Data April 2005

JAPANYOR LIBORIDOS SATDING DAS April 2005

- 8	Sample Description	Sampling Date Genue	Genue	Species	Algal Group	(units)	Counting Unit	Magn	Field Area (mm2)	# of Fields	Setting Vol. (ml.)	Algal Group # Counted Counting Unit (Nagn Field Aive # of Fields: Setting Vol. Dilution Factor (units) (mil.)	Species Unitsfinit	CYAND Total Plex CYAND Unitsimi. Unitsimi.	Plex CYAND Unitsini
I۵		080417	Anabaena	bergilminderi (2)	CVANO	~	Rameric	300	0.26	8	m	-	16	650	609
8	Terrier Pond East	060417	Aphanizomenon	Issutschenko	CYANO		flamont	400	90000	90	0	-	212		
-	Temer Pond East	050417	cyanophyte Slatters	10 CB	CYANO	74	figrate	400	0.0625	8	P	-	90		
-		711000	cyamothyte snde reli	(Sough day	CHANG		18	400	0.0605	99	(9)		101		
8		060417	Microcystis	E (1)	CYANO	es	coleny	400	0.0825	95	09	*	56		
æ		050417	Microcystis unicell	200	CYANO	Ф	8	400	0.0625	28	m	ē	五		
400	Temer Pood East	050417	distorn	50 G=121mi	BACIL	×	18	430	0.0825	扇	m				
100	Terrer-Pond East		permate distorn	ST CD=CSund	BACIL	ж	8	900	0.0625	8	m				
-011	Tamer Pond East		chiomotyte colony	(B) (B)	SHOR.	×	colony	400	0.0625	\$	m	-			
77	Tatter-Pond East		Costerum	acutum var vanable	OH OH	*	18	300	920	8	on	-			
77	TenerPordEas		Coelastrum	可量	CHOR	×	colony	200	0.26	8	m	-			
10	Tener Pond East		Eutetranorus	E 98	OH CR	*	Autopoo	200	0.26	99	m	-			
m			Scanedarms	(EZ) (B	SKOR.	26	CORON	400	0.0625	96	n	-			
-	Tenter Pond East		Spirogina	OH.	OHLOR	×	florrett	904	28853	-	77	-			
-	Terrer Pond Eag.		Starrestrum	50 Carps	SHOR	н	Ties.	400	0.0625	98	3	-			
-	Terrer-Pond East		cryptoptyte	to OHAmi	CRYFT	×	78	400	0.0025	8	779	-			
100	Terrer Pond Eag	050417	cryptoptyte	to Charry	CRIPT	-	罗	400	0.0005	8	eq	-			
-01	Temer Pond East	050417	Ceration	hrundrelle	CRADP	100	100	200	250	8	-	-			
100	Terrer Pond East	050417	Trachelomonas	ú	STOLE	×	195	98	10	8	91	-			
-	Tanar Pond East	050417	Infrinchions	gracia	XANTH	=	. poo	9	0.0005	8	0	-			
-	Terrer-Pord East	050417	unicel, oxidited 25-5am	320		*	Till Control	400	0.0625	8	m				
-	Tambring East	050417	uncel, sphere 25-5um	a		H	peo	400	50000	8	19				
79	Therefor Dodg East	2000000	control architect E 7 Each.	9000		,	- Inne	- dende	0.000	ST.	**	Ī			

GreenWater Luborations Serpting Data April 2005

Sample Description	Sampling Date Genue	Genus	Species	Algal Group	# Counted (units)	Algal Group # Counted Counting Unit Magn (units)	Magn	Field Area (mm2)	# of Fleids	Setting Vol. (ml.)	Field Area & of Fields: Setting Vol. Dilution Factor (mm2) (mm)	Species Units/mil.	CYAND Tetal Plex CYAND Unitsimi. Unitsimi.	Yex CYAND Unitsimi.
9 Student Union	711090	Anabaena	bergillminderi (2)	CYANO	-	Sament	300	0.25	8	eu		11	1,387	88
	060417	Aphanizomenen	10 G	CYANO	-	famont	100	280.63	-	ex	-	-		
9 Student Union	080417	Aphanizomenon	(g) da	CYANO	-	flament	200	87.6	9	ev	*	-		
0 SpdertUnion	5,0417	cf. Roments	ū	CVANO	-	figrater	400	50000	909	c		316		
9 StudentUnion	050417	Linnothis/Pseudarabsena	di.	CYANO	M.	figraect	400	0.0825	20	ru	-	327		
9 Student Union	050417	Microcystis	sp. (small colony)	CYAND	**	colony	400	0.0625	28	2	7	18		
9 Saderchion	050417	OSOSISTING Nament	ND (TI	CYANG	实	Starter	430	0.0825	扇	ry		972		
9 Ströertühon	059477	Plankolnghra	undatata	CYANO	gen)	Named	400	0.0625	8	ee	-	9		
9 Separtimon	060417	Planitothnik	E (1)	CYANO	ie	furnient	100	288.53		*	-	m		
g SydertUnon	050417	Nitrachia	= 0 C = 70 smil	BACIL	8	18	8	0.38	28	-				
9 Studentunde	050417	pertrate diatom	30 G=15um	BACIL	×	3	400	0.0625	8	ra.				
9 Sudertilmon	250417	pergale datom	an d.=15am	BACIL	*	100	400	0.0625	98	24	-			
	050417	perhate dators	30 C.=100uml	BACIL	-	95	200	0.35	86	-	-			
	050417	Synedra	No distant	BACIL	×	18	400	50900	8	PH				
9 StobertUnon	050417	Unosolens	50	BACI	н	18	400	0.0625	9					
9 Sydestimon	060417	Actoristics	Sandrachs:	G4.0R	ě	CONTRA	900	500	05		-			
9 Sudertilinon	050417	Artestroberthus	draole	DECR	6	99	450	0.0625	9	e				
9 StdentChion	215000	Anistbodemus	100	90,00	-	75	400	0.0605	9	**				
9 Sedertunge	050417	Bothesonon	Destante Plant	ONCOR		colony	100	288.53		e				
9 SydnetChich	050417	chincoloda minut	19) 41	00409	=	CORDAN	9	0.040%	- 65	, dis				
9 Sydericknon	0/0417	Chaterian	action ver variable	ONCH	O	-	400	0.0625	8	e				
9 Stedart byes	0403417	Centraleutla	Constitute.	00900	()	coloni	300	90.0	69					
G Stolettimon	050417	Diterocydda	244	OCCR	-	colony	907	20900	18	, (F)				
6 Sudantibile	040417	Eldistribus	veide	04.00		colors	400	0.0005	8	e				
9 Student Union	060417	Francisco		90,400		Coll	400	0.0625	8	. (**				
6 Sydnetimon	060417	Kotosla	Interestal contable	0000		7	400	0.0005	1.5	10				
9 Sudertillion	060417	Monorabidian	contorna	0408		Col	400	0.0625	129					
g Sedant bron	050417	Monographic	Section and	ON ON		T.	400	0.0635	100					
9 Suderclinion	060417	Monoraphidum	affithi	OHOD	o		400	0.0625	9	100				
9 SudertUnce	050417	Munosofia	- 57	OHOR	H	Samer	300	288.63	-	. 64				
9 Sadertines	711050	Petiethum	bovenim	SOHO2	-	Collany	400	0.0625	08	0	-			
9 SudentUnion	(60417	Pedantum	dules	CHOR	×	colony	8	920	90	*	-			
9 Stotet Unon	050417	Somedesmus	quadrosida (4 celts)	OH CH	×	colorny	400	0.0625	9	174	-			
9 SydertUnds	050417	Scanedasmus	(D) (B)	CHOR	æ	Autopo	8	0.23	8	r	-			
9 Suderführen	050417	Stanstum	3D (BRDH)	CHCOR	×	76	100	265.53		ė	-			
9 Subertilinon	214090	Tebushum	Tiergulere	OHLOR	36	3	400	0.0825	8	24	-			
9 Sedentunon	060417	Dinobyon	OF CO.	OHRYS	×	COORNY	400	0.0625	99	es.	-			
9 SudertUnion	050417	cryptophyta	sp. (D=Sum)	CRIPT	×	100	400	0.0625	8	P.	-			
9 Subsettinon	060417	cryptophyte	sty (D=Sym)	CRYPT	×	8	400	0.0625	8	PN	7			
9 Sudert Union	050417	cryptophyta	50 (L=0,m)	CRYF	-	160	400	0.0625	8	ev	-			
9 Suderfünde	050417	Ceratum	Shundnelle	CINOP	×	39	900	0.0003	S	PI	T			
9 Stobilithon	212000	dischapitate	to (Da Mum)	CHNOP	×	195	8	0.38	98	e	-			
9 Student Union	050417	Trachelomonae	sir	11011	at .	200	8	205.53	-	er	-			
9 Sydert Union	060417	Isthmochoner	gracit	XANTH	se	Onl	100	260.53	+	ev	-			
9 SadertUnion	090417	unicel, ovalited 25-Sun	035			E	9	0.0625	8	es	-			
9 SudertUnit	190417	uncel, aphere 255cm	150		-	980	400	0.0625	8	PH	-			
9 Sudertünge	050417	uncel, tohers 5.75um	170		×	100	400	0.0025	- 68	100	-			56

GreenWider Luboratories Sampling Data April 2005

- 3	Sample Description	Sampling Date Genue	Genue	Species	Algal Group	(units)	Algal Group & Counting Unit Magn: Field Area & of Fields: Setting Vol. Dilution Factor: Species (units) (mil.)	Magn	Field Area (mm2)	F of Fields	Setting Vol.	Diution Factor	Species	Species CYANO Total Plox CYANO Units/ml. Units/ml. Units/ml.	Unitalist.
2	Terrier Pand South	080417	Aphanizomenon	issusscherikai	CVANO	a	flament	400	0.0625	8	m	-	272	2,223	835
=			Aphanoxipsis	E (0+25)	CYANO	-	colony	100	260 53	-	01	-	0		
7	Terrer Pond South		cf Aphanocapse	to Children	CYANO	45	/wolco	400	0.0625	8	7	-	150		
7	Temer Pond South		cyanophyte/barrent	13.00	CYANO	-	figrates	300	0.55	90	(5)		-		
2	Tarier Pond South		cyanophide single cell	ap dond	CYANO	-	(e)	400	0.0625	R	175		8		
7	Terrer Pond South		Gomphosphaeita	10.0%	CYANO		Wellow	R	0.35	B	100		60		
=	Terrier Pond South	080417	Microcystis	(L) 05	CYAND	ю	colony	9	0.0625	8	m	•	151		
2	Tenter Pand South	060417	Microcystis unicel	d	CYANO	3-	leo	90	0.0628	3	m	-	212		
2	Temer Pond South	05B472	Navoda		BACIL	je	8	400	0.0625	8	(1)	-			
=	Tamer Pond South	050417	Batycoottas	brazili (str)	CHOR	×	colony	100	288.53		m	-			
9	Tener Pond South	050417	Closterin	engue	OHOR.	×	150	400	0.0625	8	n	-			
7			Eufetranorus	10.01	OH CR	×	Augion	400	0.0625	90	m	-			
=			Occuses	司	OH CR	×	CORON	300	0.38	86	m	-			
2			Spropre	Q1	OHEOR	×	flurtett	900	288.53	-	77				
=	Terrer Pond South		Starrestum	3D C0/096	CHUCH	н	西	98	0.28	8	3	-			
=			Staurestrum	to one of	90,00	×	76	400	0.0625	8	77	-			
2	Terrie		cryptophyle		12/25	-	F	400	0.0025	8	eq	-			
2	18118		cryptophyte	up C=10ami	CRYFT	×	96	100	0.0025	S	-	-			
무	Terrer Pond South		etylophyte		CRYPT	×	100	98	NO	8	91	-			
=	Tamer Pond South		Certiforn		CINOP	×	100	9	0.0005	8	**	-			
7	Terrier Pond South	050417	Trachelomonas		310/E	*	TO TO	300	0.35	8	m				
=	TemperPond Stuth	050417	Inflamochionos.	gracile	XAMTH	H	100	400	0.0625	8	19	-			
#	Temer Pond South	050417	unioil, orathod 25-5am	000		×	100	900	0.0605	8	m				
4	Therman Process	PMC5447	section and and with the sections	2000			-	3000	A dente	5					

Gener/Water Luboratories Sampling Data April 2005

	Sample Description	8	Genue	sapeds	Algal Group	(units)	Algal Group & Counted Counting Unit Magn (units)	6	(mm2)	S of Fields	(mil.)	gn Field Area & of Fields Setting Vol. Dilution Factor Spe- (mm2) (ms.) (ms.)	Species	Species CYAND Total Priox CYAND Units/ml. Units/ml. Units/ml. Units/ml. Units/ml.	Unitalial
	417-4-South		Anabaena	10 位	CVANO	Fi.	Sameré	8	0.0625	8		-	2,813	3,367	2,814
	417-4-South		Aphanocapsa	HZP <qum< td=""><td>CYANO</td><td>4</td><td>colony</td><td>400</td><td>0.0605</td><td>8</td><td>ē</td><td>=</td><td>363</td><td></td><td></td></qum<>	CYANO	4	colony	400	0.0605	8	ē	=	363		
	417.4.South		UmothrixPveadatabeene	ū	CYANO	**	Sament	400	0.0625	8	π		6		
.0	1174-South		Morecystis	(i) da	CYAND	+	colomy	90	280.63	-	5	•	**		
100	17.4.50JB		Autacosera	gravistav engedisems	BACK	*	chain	200	970	28	ō	-			
-	417.4.South		Aufacoseira	taks	BACIL	*	chain	480	0.0625	R	e e				
-4	172.4.50uth		Navious	4p 0,=20sm)	BACIL	36	15	400	0.0825	R		-			
4	17.4.South		NESCHB	40 &=12sm	BACIL	ж	8	400	0.0625	8	=				
4	1745am	5160412	Demass dimon	4D 0.=10am	BAOL	ye.	18	90	0.25	8	7	-			
প	1745outh		permate diagon.	ED (L=75am)	BACIL	×	78	8	288.53		-	-			
-a	774.SMM		Syredia	40 G=125kH)	BACIL	×	185	300	0.00	8	-	-			
d	174.South		Syledia	30 G-50am	BACIL	×	180	400	0.0625	98	TI.	-			
-31	17-4 South		Coelestrum	10 10	OKCH	×	colony	400	0.0625	99	5	-			
4	124-South		Cosmatium	ND (large)	OHLOR	×	les.	9	288.53	-	T				
Ŧ	174-South		Coemenum	sp (med)	OHOR	н	Till O	96	97.0	95	7	-			
Ŧ	174-50uth		Didymocystis	550	90,000	×	colony	94	0.0625	8	-	-			
q	174 SMB		Oocysts	(F) (F)	DECR	×	colony	400	0.0625	90	77	-			
177	17.4.South		Pesantram	delen	POYOR	-	colony	100	0.0025	9	7	-			
व	7.4.5suft		Passatum	Defrais	ONCOR	×	colony	909	0.0625	8	~	-			
4	745suft		Scandarnus	madecasds (4 cylls)	0400	×	colony	8	0.0625	8		-			
4	74 South		Sconedarmus	30 C100	OHOR	×	colony	200	0.35	8	77				
¥	174.Suth		Scinedathur	UP (17)	0408	×	colony	400	0.0625	98	7	-			
d.	7.4.5um		Sproges	9	OKOR	×	Sarsert	8	263 53	-		-			
Åξ	17-4-South		Staumstam	th (med)	90,00	-	80	R	KI O	R					
4	17.4.5suft		Tebsobum	grangulare	OHOR	-	pio.	400	0.0635	8	-	-			
ď	174 South		cryptophyte	ND CD=Barri	CRYPT	*	百	400	0.0625	99	៊	-			
q	174-South		Trachdomonia	Ø	BJGLE		place	100	289.53	-	7	-			
ष	174-South		unself, oxalited 25-5um	dth		×	TE.	400	0.0625	B	5	7			
#	17.4.50uth		uniosil sphere 25.5um	300		×	Jeo Jeo	400	0.0625	8		-			
3	17.4.Co./h		unional contama E.7-form	200)	-	400	0.0005	92					

d. Unitshif, Unitshif, 491690 318 本学家中**別**な近れた新日本教育中**は** Dilution Factor Field Area & of Fields Setting Vol. # Counted Counting Unit Algal Group Spedes uncel, oratrod 25-5um uncel, sphere 25-5um uncel, sphere 57-5cm Staucospia Jennethro-Psychospia Anstreera Apracospia cyanotyte dism cyanotyte hisment cyanotyte hisment cyanotyte singe cell Messangeda Morecytis Morecytis unicel Oscisione Oscisione oscisiones fement Sampling Date Genus

GreenWater Luboratories Sarging Data April 2005

d. Unitshift. Unitshift. 2.503 1.627 Field Area & of Fields: Setting Vol. Dilution Factor (mm2) # Counted Counting Unit Algal Group cercinalistics aquae (1) instationarios of the community Advanceror an appropriate operation of a cyanotypic classes operations of a cyanotypic allower operations of a cyanotypic properations of a cyanotypic properations of a cyanotypic cut of Sampling Date Genus

GreenWater Luboratories Sarging Data April 2005

CYAND Tetal Plex CYAND Unitsimi. Unitsimi. Field Area & of Fields: Setting Vol. Dilution Factor (mm2) # Counted Counting Unit Algal Group Spedes Sampling Date Genus

GreenWater Luboratories Sampling Duta April 2005

Sample Description	Sampling Date Genus	Genue	Species	Algal Group	(units)	Algal Group & Counting Link Magn. Field Ave. & of Fields. Setting Vol. Dilution Factor. Species. CYANO Total Plox CYANO (mil.). (Inhibited. (inhibited. Unitabilit. Unitabilit. Unitabilit.	Magn	Field Area (mm2)	# of Fields	Setting Vol.	Dilution Factor	Species	CYAND Total Unitshill	Vox CYAND UnitsimL
15 417-1-South	080417	Anabaera	circinalis/fos-aguse (f)	CVANO	,	Sameré	900	0.0625	8	e		151	ICU	9.09
15. 417.1. Suits	650417	Achenocense	sto clum	CYANO	-	colorie	400	0.0605	28	(0)	-	R		1000
15 417.1.South		UmodimoPosadatubaena		CYANO	-	fiament	400	0.0625	8	-		342		
15 417-1-South		Microcystis	50 (f)	CYANO		colemy	900	0.28	8	n	7	z		
15 417-1-South		Microcystis unicell		CYANO	유	160	400	0.0625	98	05	**	300		
15 417.1.Suth		esolistorian frament	E 00	CYAND	e'v	Setter	400	0.0625	R	100		60		
15 417.1.50uth		WoonchayCoelonora	gi gi	CYAND	m	colony	280	0.25	R	m	-	10		
15 417-1-South		Authorseits	taks	BACIL	isc	chain	8	0.28	8	m				
15 4123 Sum		centric detain	sp @=t0am	BAOL	×	18	400	0.0625	8	m	-			
15 412-1-South		Nariode		BACIL	*	8	400	0.0625	8	m	-			
15 417.1.Sum		NESchie	30 G=10sml	BACIL	×	18	400	0.0625	8	n	-			
15 417.1.South		NEScha	30 0.<25um	BACIL	*	(Se)	400	0.0625	90	m	-			
15 417-1-Sun		Bothyocorcus	brazil (95)	OKCR	æ	COSON	200	0.38	86	n				
15 412-3-South		cf. Didymocystis	Ú.	OHOR	×	Autopo	400	0.0625	8	77				
15 417-1-South		Closterum	acutum ver variable	OHOR	н	Ties of	98	97.0	93	3	-			
15 417-5-5um		Closterum	10 OF	90,000	×	190	400	0.0625	8	179	-			
15 417.1.South		Coelabum	13 #	DALCR	-	Autopo	400	0.0625	98	61	-			
15 417-1-Such		Didynocydds	Na.	POYO	100	colony	400	0.0025	8	-	-			
15 417-3-50uft		Kitchneridle	B (3)	ONCR	×	18	400	0.0625	8	99	-			
15 417.1.50uft		Occystia	0.00	00000	-	Colory	99	0.25	8	0	-			
15 417.5 South		Occyritis	10 OF	ONLOR	×	colony	400	0.0025	8	-				
15 417-1-Sum		Pandooha	motivas	90,00	H	colony	98	0.03	8	19	-			
15 417.5.5um		Pedathan	botystnam	OKOR	×	coluny	8	263.53	-	m	-			
15 477.1.South		Pedantum	Defrait.	90,00	-	Autopo	400	0.0625	9	m				
15 417.1.5outh		Philocionum	9	SHOR	-	Starties	100	28553	+1	m	-			
15 417.5 Surft		Scanodosmus	tocardatas	90,00	~	colory	400	0.0625	98	6	***			
15 417-1-South		Scanodostnús	obtinus	90,00	-	(colory)	400	0.0625	8	m	-			
15 417.1-South		Somedermus	quadricauda (4 celts)	OHOOR	×	colony	400	0.0625	98	m	-			
15 417,1.50uth		Scanedarmin	10 (3)	OHOR	in	colany	400	0.0625	8	m	-			
15 417.1.Sa/ft		Spingina	in the	OHOR	=	Maner	300	269.53	-	m	-			
15 417.1.South		Starestrum	(HCURI) (TE	SOHO HOS	-	100	000	0.35	98	m				
15 4721-Suth		Tetrastrum	heterocondum	OHOR	×	8	8	0.38	28	-				
15 412-1-Suit		cryphobyts	at Chefami	CRYPT	н	8	400	0.0625	- 05	3				
15 417-1-Surft		Оурторътн	10 (D-SIM)	CRYPT	æ	75	400	0.0625	28	*	-			
15 412.1.South		cryptophyte	sp &=10sm	CRYPT	×	100	400	0.0625	050	6	-			
15 412.1.Spoils		Ceratum	hrusdhelæ	CRNOP	16	更	400	0.0625	98	m	-			
15 412-1-South		Istrinochione	grasie	SAMITH	×	(8)	100	288.53		191	-			
15 417-1-South	050417	unicel, ovalkod 255gm	410		×	100	900	0.0625	8	113	-			
15 417-3-South		uncell, sphere 255pm	370		×	180	400	0.0625	8	77				
15 417.1.South	050417	urscell aphere 5.75cm	975		×	195	400	0.0605	8					

GreenWater Luboratodes Sampling Data April 2005

Description					(mits)	(units)		(mm2)		(mm2) (ms.) Unite/m		Uniterial	Unitsimi, Unitsimi,	Unitsimi
15 417 UHV. NW	711080	Anabaena	circinalisfics-aquae (1)	CVANO	-	flamere	300	0.25	8	Ç4	-	F	420	11
10 417 Univ NW		cyanophite sngs rail	ED GOOD	CYANO	18	B	400	0.0605	28			181		
16 417 Univ NOV	2	UmothroPosdatabson	ū	CYANG		figrated	400	0.0625	8	c	-	10		
16 417 Univ. NW	40	osolatman fiament	日日	CVANO	-	Demont	400	0.0005	90			19		
16 4T/Univ NW	200	Plantolynghys	undaliste	CYANO	m	figner	400	0.0625	R	r		92		
16. 41TURN NW	050417	pernate diators	10 0.=10sm)	BACIL	-	76	400	0.0625	R	ex				
16 417 Una NW		pernate dators	10 0=251ml	BACIL	ж	960	200	0.25	R	re	-			
16 412 Univ NW	100	Synedia	10 Q=20m	BACIL	ж	18	400	0.0625	8	ce				
16 417 Univ NW	wo	of Chalmocystis	0	SHUR	×	colony	400	0.0625	8	~	-			
16 417 Univ NW		d Radioflum	Di Di	OHOHO	×	Marsett	100	288.53		ć.	-			
16 4TChin IN		chlorophyte flamest	日の日	OHON	×	figner	100	283.53	-	(H	-			
16 417 Univ. NW		chicrophyte flament	10 (A)	SKOR	×	Slanett	001	288.53	-	-	**			
16 417 Driv NW		Costerum	action variable	OKOR	×	190	200	0.25	060	e.				
		Coelectrum	10.00	OHEOR	×	Autopoo	300	0.26	8	e4				
		Cosmenum	50 (Bright)	OHOR	н	THE OWN	400	0.0025	8		-			
16 417 Univ NW		Coemanum	to med	90300	×	960	400	0.0025	98	cy	-			
15 417 Univ MV		Cramanus	the Chinal	DECR	×	哥	200	0.25	98	e	-			
15 4TF CINN, NW		Monoraphidum	104	BO340	×	(90)	400	0.0025	9	**	-			
16. 417 Univ. NW		Magedia	Si Si	OLOR	×	Marsett	98	0.25	8	es				
10, 417 Univ. NW		Osychonema/Sphaeropogma.	ST ST	0400	×	chan	100	288.53	-	ė	-			
10. 417 Univ. 18V	050417	Pandotha	monum	OHOR	×	colony	200	0.25	8	**	-			
10 417 Univ 18W		Scandomina	10 C33	90,00	×	colony	400	0.0625	98	c				
16. 417 Univ. NW		Spingers	St.	OKOR	×	Stanier	100	263.53	-	178	-			
18 4TFUNW NW		Staurastum	stb (stable)	90,90	-	geo	400	0.0625	R	n				
16. 4TT UNIV. NW		Strumstam	tip (med)	SHOR	-	Cold	200	0.33	8	re	-			
18 417 Univ MV		Strandesmus	sp. (phot erri	90,00	*	百	900	0,0805	20	c	-			
16 417 Univ NW		Zygnema	10 (1)	OHOR		Signatur	300	970	8	**	-			
16 - 417 Univ. NW		cyclophts	sp. Cl=10km0	CRYPT	×	푱	400	0.0005	98	ė.	-			
		cyptophyte	ap Carfumi	CRYPT	in	Jeo.	400	0.0625	8	ca	-			
16. 4T/Univ. NW	050417	Ceratum	hirutdhelia.	DMOP	×	18	200	970	200	es	-			
16 417 UNW NW	120	uncel, ovalited 25-5um	300		×	180	400	0.0625	98	C*	-			
	20.0	unicel, sphere 25-5um	005		н	8	400	0.0625	8	2				
10 417 Univ 109	050417	unicel, sphere 5-7 fum	0.05		н	le:	400	0.0625	- 20	. 7				

Sample Description	Sampling Date	Genue	Species	Algal Group	(units)	Algal Group # Counted Counting Unit Nagn (units)		Field Area & of Fields (mm2)		Setting Vol. Dilution Factor (ml.)	Species Unitraint	CYAND Total PI Units/ml.	ex CYAND Unitsinu
17 Horato 1/2 Viter	713000	Nizschia	ID-0-30mi	BACIL	-	OB! do	0.0	0000	-	-		0	
17 Horato 1 @ Viser	060417	Activashum	gaphrun	90,90	CH	colony 40	000	0.0625 70					
17 Horato 1-8 War	050417	Chlorosopium	i i	0408	8	Col	0 0	0.0625 70	72				
IT Months (Styline	060417	Elebrana	5	500	G F	Gi. Pringer	9	10.63	0.5				
17 Months till blogs	060443	Colabinopose	100,000	04400	0	The state of the s	100	0.000					
17 Monto (Moto)	2500147	Votesta	Montesta Constitute	0770		-		0.0000	10				
17 Charles 1 (B) Spin	000000	Adontor mobile so	Colores of Colores	00000	(3	-	9	11 man 1					
17 Months Collision	060447	Monocontiduo	orthern orthern	0000		5 70		(CORT) 70					
17 Gones Collins	190000	Monorman de la company de la c	The state of the s	9000	()	-		0.0000					
THE COUNTY OF		mini aprimari	11000	5000		5.7	2.5	Sales Sales					
THE PROPERTY OF THE		MOTOR SPITISH	100	58	80	F 2	200	0.000					
TO STATE OF THE PARTY OF THE PA		ocaselesmus	meghus	50	e i	(Many		000	5/				
17 moratio Lighted		DOSTROBERIUS	CARONCASOB	SACH.	*	county 40	0	07 07900					
17 Harako 1 (g) Well		Scanedarnus	(2) st	OKOR	×	(0000)	0	0.0605	3)				
17 Horatio 1 (I) Weir		Schoedera	1D (II)	900	×	90	0 00	0.0025 70	T				
17 Hordto 1@Wei		crystophyte	Sp. O+12mg	1265	н	¥ 150	00	0.0025 70		-			
17 Horato 1@Viter		cryptophyte	sto (Distant)	CRVFT	×	7	000	0.0025 70	-	-			
17 Horato 1@Vies		cryptophyte	up Q=12aml	CRITE	×	(F)		0.0025 70	3.				
17. Horato 1@Vine		aracel, orialtod 25-5am	dth		M	cel 400		0.0025 70	-	-			
17 Horato 1 (D Weir		urscell, sphere 25.5pm.	dhi		×	909		0.0005	5	-			
17 Hondo 1@Wein		uncel, aphere 5-75em	9		×	900	00.00	0.0005 70		-			
15 Horato 2 @ Weil		Aphanocipia	up (DH15un)	CVANO		CD AUGUS	000	OE 5090	7	-	8	270	
13 Hondo 2 @ Well		Dyanophide colony	10 01	CYAND	**	CORDA 4D	0.00	0.0625			50		
18 Horato 2@Wee		Limothii/Seadstabens	-55	CYANA	-			0.0625 70			99		
10 Horato 2/8 Vier		Maturitada	benassana	CYANO	r	colony 30	00	90	ī		36		
18 Horses 2-B Vise		Macoula		BACIL		Cod 4	0 0	0.0005 700					
13 Horato 2 ch Was		MESCHI	120 A =50,000	BACIL	0	100	9	80					
19 Hondo 2 (f) Viair		Superior		BACH		100	9	08 50					
40 Monte 2 Politica		Achiencemen		CALCO		Code All	0	0.0408					
10 September 2-8 Warr		of Questionide	-	9000	c)	cularus 40	0.0	0.0005					
10 Months Of Other		chicrophoto colono	Q t	0000	6	Or management		0.00					
10 Locate 3 (8) (Super-		Codemies and	100	000	e i	Transport of the last		m m	05				
18 HOURS 2 (B) 1982		Commence	100,000	500	0	CONTRACT OF		0.0000	3.5				
18 House 2 Million		Performan	1000	04/0		OF THE PERSON		00000	0.7				
12 November 200 Open		Distrockedon	7.7	000	0	Ontonio All		0.0005					
18 Horsto 2.69 Mar		Fichman	7.6	00.00	0	Colors (20)		0.00					
18 Horsto 2/09/libr		Fitzeramons		0400	6 3	colors 40	0	SONOS AN	ē				
18 Horato 3.69 Visio		Kolisla		9570	G	Col.	0.0	0.0005					
18 Horato 2 @Wer		Managedidim		OHON	(8	7	0.00	0.0000	-				
ti Horato 2/00/Ner		Monoraphidum	. 17.	ONLOR	*	99	0 00	0.0000					
19 Horato 2/0 Vien		Moscraphillum		ONCH	×	等	0 00	0.0625 70	7				
18 Horato 2/0 Viter		Monoraphidum	griften	OHOR	×	90	0 00	0.0625 70	7	7			
10 Horato 2/@YHer		Monorophidum		OHOR	×	90	00.00	0.0025 70	7				
11 Horato 2-@VHer		Miteraphidum	-77	OKOR	×	78	00	0.0025 70	-				
18 Horato 2/8/WHI		Scanedesmus	77	DACOR	×	colony 40	00 00	0.0025	7	-			
18 Hondo 2 @ WHI		Scanderman		POTO	×	colony 40	0 00	0.0005					
19 Horato 2 (BYHH)		Scendelmus	magnus	OLOR	×	colony	8	90	7.0				
10 Hondo 2/g Wee		Scandalmus	Π:	9000	×	(cleary 40	0	0.0025					
10 Montes 2 (2) When		Scandolmus	77	950	-	com/	00	0.0005					
19 Horatio 2/07/Har		Scanedaltrul	-	0400	×	colony	0.0	0.000					
THE PROMOS SERVICES		Scholathus		550		A STATE OF THE PARTY OF THE PAR	0.0	00000	20				
12 TO MAN 2 GO PANE		2,43,904,00,0	E .	5 6		(count)	2 5	070000					
THE PERSON OF TH		198798		2000	4.9	5.7	25	0.0000					
10 Months 2/8/Min		Children Stiff Children Chronoses	Topologie	0.000	40	Of the second	200	0.0000	3.5				
to Months 2.8 Man		composite.	an Alla Scand	CONDI		La sun		9 9 9					
18 Horato 2 (BWar		Fusions		BIDLE		100	0 0	00835					
18 Horato 2 @ Wei		Explore	+ 55	BIGIE		18	9	188.53	37				
19 Horato 2 @ Wer		Techeomones	Til I	BIGLE	×	100	20	189.53					
18 Horato 2 @ Wen	050417	unicel, oxalited 25-5am	âts		×	7	0.00	0.0625 70	50	П			
18 Horato 2 @ Weir	060417	uniced, sphere 25-fum	310		н	Gel A	00	0025 70	-	-			١

Sample Collection Date



Microcystin Analysis Report

Project: University of Central Florida Dr. Martin Wanielista

Sample Identification UCF 1: Filtrate 1 1) 2) UCF 2: Filtrate 2 3) UCF 3: Filtrate 3 4) UCF 4: Filtrate 4 5) UCF 5: Filtrate 4b 6) UCF 6: Lake Patrick 7) UCF 7: Terrier Pond East 8) UCF 8: Terrier Pond South 9) UCF 9: 417-5-South 10) UCF 10: 417-4-South 11) UCF 11: 417-3-South 12) UCF 12: 417-1-South 13) UCF 13: 417-2-North 14) UCF 14: Lake Condel South 15) UCF 15: Horatio 1 @ Weir

Horatio 2 @ Weir

Student Union

16)

17)

Sample Prep – The samples were sonicated and filtered. At least one duplicate per batch of samples was spiked with 1.0 μ g/L MCLR and recovery rate calculated.

Analytical Methodology – A microcystins enzyme linked immunosorbent assay (ELISA) was utilized for the quantitative and sensitive congener-independent detection of MCs. The current ELISA kit is sensitive to all MCs (LR, LA, RR, YR, etc.) down to a detection/quantification limit of 0.15 µg/L. MCLR standard and spike recoveries averaged 63-74%.

Cyano



Summary of Results

Samp	le	MC levels (µg/L)
1)	UCF 1 : Filtrate 1	< 0.04
2)	UCF 2: Filtrate 2	< 0.04
3)	UCF 3: Filtrate 3	< 0.04
4)	UCF 4: Filtrate 4	< 0.04
5)	UCF 5: Filtrate 4b	< 0.04
6)	UCF 6: Lake Patrick	0.05
7)	UCF 7: Terrier Pond East	0.06
8)	UCF 8: Terrier Pond South	0.08
9)	UCF 9: 417-5-South	0.12
10)	UCF 10: 417-4-South	0.15
11)	UCF 11: 417-3-South	0.09
12)	UCF 12: 417-1-South	1.36
13)	UCF 13: 417-2-North	1,56
14)	UCF 14: Lake Condel South	0.04
15)	UCF 15: Horatio 1 @ Weir	0.45
16)	UCF 16: Horatio 2 @ Weir	< 0.04
17)	UCF 17: Student Union	< 0.04

Limit of Quantification = $0.15 \mu g/L$



University of Central Florida: Microcystin Results

Analysis via ELISA

Sample ID	Initial Conc. Factor	Dilution Ratio	Final Conc. Factor	Assay Value, ug/L	Std. Recovery	Corrected Spike Recovery (%)	Final Corrected Concentration (ug/L)	Average (ng/L)
UCF-1	1x	0	1x	0.02	77	98	< 0.04	< 0.04
Filtratel		0	1x	0.03	77	98	< 0.04	
UCF-2	1x	0	1x	0.02	77	98	< 0.04	< (0.04
Filtrate2		0	1x	0.02	77	98	< 0.04	
UCF-3	1x	0	1x	0.03	77	98	< 0.04	< 0.04
Filtrate3		0	1x	0.01	77	98	< 0.04	
UCF-4	110	0	1x	0.02	77	98	< 0.04	< 0.04
Filtrate4		0	1x	0.02	77	98	< 0.04	
UCF-5	tx	0	1x	0.03	77	98	< 0.04	< 0.04
Filtrate4b		0	1x	0.03	77	98	< 0.04	
UCF-6	1x	0	1x	0.04	88	89	0.04	0.05
Lake Patrick		0	Ix	0.05	88	89	0.06	
UCF-7	tx	0	Īx	0.67	88	89	0.08	0.06
Terrier Fond East		0	1×	0.04	88	89	0.04	
UCF-8	Ix	0	1x	0.06	88	89	0.07	0.08
Terrier Pond South		0	1×	0.07	88	89	0.08	
UCF-9	1x	0	1x	0.08	88	89	0.09	0.12
417-5-South		-0	1x	0.13	88	89	0.15	
UCF-10	Ix	0	lx	0.11	102	98	0.11	0.15
417-4-South		.0	1x	0.10	102	98	0.19	
UCF-11	Ex	0	Ix	0.09	102	98	0.09	0.09
417-3-South		.0	1x	0.09	102	98	0.09	
UCF-12	lx	1/10	10x	1.64	54	94	1.74	1.36
417-1-South		1/10	10x	0.92	.54	94	0.98	
UCF-13	tx	0	1x	1.33	54	94	1.41	1.56
417-2-North		0	1x	1.61	.54	94	1.7	
UCF-14	1x	0	1x	0.02	102	98	0.02	0.04
Lake Confel South		0	1x	0.06	102	98	0.06	
UCF-15	1x	0	1x	0.45	.54	94	0.48	0.45
Horatio 1 @ Weir		0	1×	0.40	54	94	0.42	
UCF-16	Tx:	0	1x	0.03	102	98	< 0.04	< 0.04
Horatio 2 @ Weir		0	1×	0.03	102	98	< 0.04	
UCF-17	tx	0	1x	0.01	102	98	< 0.04	< 0.04
Student Union		0	1x	0.02	102	98	< 0:04	

Quantification limit = 0.04 μg /L na = not applicable

Analyst: C. Williams

Date: 9/2/2005

Colorable Marinet Colo	Sample	Sampling Date Genus	Owner	Species	Algal Group	A Coursed C	Ugal Group # Counties Counting Unit: Magnification (units)	Magnification	fand Area	# of Fields	Settling Val.	Settling Vel. Dilution Factor (mL)	Species	Units/mf.	Phes CYAMD Unitable
Control Cont	-	ii.	Contractive Righter	111 95	DYAND	111	Sarar	433	0.0825	77	-		2,863	2,028	
Comparison		18	d Pasitahroba	1 19	CVAND	i re	Samer	433	0.8825	2	-	-	130	200	
CAND District Di	_	8	Danaphie snote cell	Sta Januari	CYAND	179	Ced	200	0.8826	20		-	130		
66 Applications CAMID CAMID Interest 40 CAMID Interest 40 CAMID Interest 40 CAMID Interest 40 Interest 40 CAMID Interest 40		8	Custochule Batalet	80.08	CYANG	0	Harrer	303	0.76	33	-	**	E		
### CAMPAN CONTRACTOR The Part of the CAMPAN CONTRACTOR THE CAMPAN CONTRAC		8	Aphanat spisa	10.00	CYAND	-	V0003	400	0.0425	2	-	-	9		
March Marc	_	18	systophys flament	11 12	CYAND	-	Status.	403	0.1825	25	7	-	贸		
Control Apply Reserved customer in the control 2-5 farm COARD			Anabaena	0 4	CYANO	-	flament	100	280.53	-	-	-	-		
Control of the cont			uncell, spring 2.5 Sun	100		×	Dec	401	0.0025	TT.	-				
OF consistive flushert to (1) CAND 0 Davies 40 10 CAND 0 Davies 70 10		,	uncell, ovaphod 25-5µm	100		×	160	403	11175	12					
OF Compactive function of the Compact of the Compact of the Compactive function of the Compact of the Compactive function of the Compactive fun		15	speoply@flaner	10.11	CYAND	0	Spriet	401	0.0405	22	-	÷	218	986	o
OF STATESTATES CARLO			Dysophyte Element	62.19	CYAND	rv	famen	401	0.0005	77	-	_	130		
Compact of the control of the cont	-	i	Hardstool .	10.03	CYAND	+	Daner	E	930	Ħ	T	-	R		
December 15-5 farm			pensis datim	so L=2hm	BACK	×	183	400	0.005	10	-	-			
Controlly failure Control Cont			uncell sphere 155um	throft to		×	T	107	11025	77	*	-			
Controlly Reserved 10 CYAND 0 Newert 431 LRICS 11			uncel, coating 15-5um	100		×	iel	400	11025	111					
Compactive largered Control Co		ı	syanophyse flament	10 (1)	CYANG	100	Same	401	0.005	10	-	-	316	050	0
Protective under set 10 10 10 10 10 10 10 1	26		systophyte Nament	127 03	CYANG	+1	flamen	100	111125	THE STREET	-	91	130		
Colored State Colored Stat	100		syangebyte single cell	10,78491	CYAND	m	191	400	0.08255	22	-		130		
Control of the cont	ćs		Parktebro	10 10	CYANO	+	Harvert	101	283.53	-	-	-	-		
Control of the cont	10		rocitatorian tlament	110 011	CYAND	-	Saner	100	283.83	1	-	***	-		
Discontinguality Discourage	80		uncell, ovalind 15-5xm	101		×	200	401	1190	12	-	-			
Company the father Company Com	es.		snott, uther 255m	180		×	Till	933	111125	12	-	400			
06 cyclosophye februst 40 (7) CANIO 9 februst 40 (1) CANIO 9 februst 40 (1) CANIO 5 CERT 40 (1) CANIO 6 10 (1) 7	200	ı	unicrowe flageliste	to Defamil		*	tent	403	1,1425	710		-	0.000		3
05 Oversoft-yes stells of a literal CCAND 5 (44) 1 (44) 403 1 (45) 7 (44) 06 sectlement seed of a literal		h	syanophyte Hament	(2) (3)	CYAND	an	flatters.	403	8313	12		-	285	1,227	0
05 operatory largest 401 CCAHO 2 Ramer 401 18875 71 06 secolar outsite farmer 402 CAHO 2 Samer 401 18875 71 06 secolar outsite farmer 400 CAHO 2 Samer 400 18875 71 06 secolar outsite farmer 400 CAHO CAHO <td>77</td> <td></td> <td>Cystrophyte single cell</td> <td>10 36401</td> <td>CYAND</td> <td>in</td> <td>183</td> <td>403</td> <td>11829</td> <td>111</td> <td>-</td> <td>_</td> <td>11/4</td> <td></td> <td></td>	77		Cystrophyte single cell	10 36401	CYAND	in	183	403	11829	111	-	_	11/4		
Columnian farment at 20 CARIO 2 Standard 420 LRCS 73 CARIO 2 Standard 420 LRCS 73 CARIO 2 Standard 74 CARIO 3 STANDARD 74	7	i	Cyasophile flament	80.11	CYAND	e	flaver	409	に製品	78	-	_	×		
05 ansolit cystolou 23-Sum 100 x Left 403 DIFCS N 06 unicoun flagistate application application x cold 403 DIFCS N 1 06 unicoun flagistate application application application x cold 403 DIFCS N 1 <td></td> <td>1</td> <td>ssolutarian filament</td> <td>単口</td> <td>CYAND</td> <td>rı.</td> <td>Samet</td> <td>400</td> <td>0.0005</td> <td>77</td> <td>-</td> <td>-</td> <td>130</td> <td></td> <td></td>		1	ssolutarian filament	単口	CYAND	rı.	Samet	400	0.0005	77	-	-	130		
00 and county species 25 shim in the 27 s		1	incell orange 25-5um	100		×	3	403	0.9825	22	-	-			
Objective Registration of Local States DACE And States Control Annual States DACE Annual Annual		1	ancell, sphere 25 fam.	100		×	167	401	0.1825	20		-			
Others of the control of the contr		1	anicova liagnists	# (5-1) Par		×	H	403	0.1620	12		-			
Charachyte artest 10 CHCR		1	penate datam	10 L'SHIM	BACH.	×	000	401	1,1925	=					
Op. Character states Total Control Country Country of the Country Country of the Country Country of the Country Country of the Country		1	CHUOSTAN INGREDIE	10.01	EH CH	×	100	400	11825	M					
Control Cont		I	Chingphyte uncell	th Delant	CHLOR		101	101	100	-		0			
Co. Control of the control		١	NEXICUS	10 6-28smg	BALTA		E C	200	283.53	-					
Company Comp	n i	S	plant deprivation and the cells	thus to	CLANG	0.0		400	11000				71	28.5	0
Comparison of the control of the c	01.4	58	Cyatograph Harnest	17.00	CAMID		Tarrer.	493	0.000	2		- 1	0.00		
Comparison	2.3	9 2	Contract the married	E 1	00000		1000	1000	2000	2.5		. ,	0.7		
00. Description inserest 01.11 CARIO 1 Inserest 01.11 01.00 01.0	9 4	8 8	ACRES DE L'ALTERNATION	9 1	200000	, ,	A COLUMN	440	0.250.0	2.5			9 0		
Characteristic Characterist Ch	0.0	88	Cyano-Daddo Harasti	E 8			Take a	100	0.000		1.5		7.1		
00 modelativity flavor 1 5 5m to 10 73 CVAHO 1 Mayor 403 10 10 73 71 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		8 8	Control of the last of the las	2 = 1	00000			100	2000				2.5		
Control State Control Stat	9 3	1	CHICAGO.	4:	CARRO	4 -	8	400	The second	e ;			1 !		
Column C	2.1	1	DOMESTICAL AND ADDRESS OF THE PERSON AND ADD	57.01	CIVINO	-	Marrier.	455	2000	2 :					
Co. Account taped as Co. Co. Co. Co. Co.		1	MICHILISTRAN 2 STRON	100		K	100	100	0.000		10	-			
05 Introduction Highway 10 (2-15) and 10 (2-	a i	I	thickness haged der	th County		-	E 1	400	11000	5 ;	31				
05 stroop # 1964 # 10 L * 7 5 m 7	0	1	BURDONE SAGOSTIB	10. 6.2°13ams		-	000	401	0.08529	the state of	70	-			
05	0.1	1	ERIODON TABBILITY	10 5,175,017	Cont. 600		161	493	1960		7.1	-0			
OS PRODUNCE NEED ON SO CHICAGO CONTRACTOR CO		ì	mandaline solarly	5 11	CHICK	×	Augos	100	0.8625		7.7				
And the state of t	94	ĺ	CHOCOLINGS BALIFE CRI.	SB (4-2) res	CHICA	m 3	E 7	400	Cycle Cycle	2,5					
	4.4	Ī	Distribution of the control of the c	A p-2007	2000	83	100	200	190	4 3	53				

	Sample Description	Sampling Date Genue	Genus	Species	Algal Group	# Courted (units)	Counting Unit	# Counted Counting Unit Magnification (units)	Field Area (mm2)	# of Fields	Setting Vol. (nl.)	Settling Vol. Dilution Factor (mL)	Species	CTAND Tetal Unitshit	Ples CYAND Unitshit
40	Lake Patrick	8	Planktothrix	agandhilmougeofil	CYANO	8	Sament	900	0.0825	10		-	3,629	5,011	3,758
10	Lake Patrol	98	DARRENGE Namen	10 11	CYAND	ID	flarer	403	0.0825	178	-	***	340		
90	Lake Partick	8	Aphanacapsa	豆田	CVAND	0	Auggo	107	0.9825	22	=	*	388		
*	Lah + Patrick	8	Anabasna	(B) 4	CYKNO	PH	flament	400	0.0625	70	-	-	130		
w	Like Papick	16	pystochyb single cell	10 709	CYANG	m	192	400	0.0025	E	7	-	130		
10	Lake Pagests	8	Aphanicaps	E #	DYAND	-	Austra	100	0.1825	75	-	-	SI		
0	Likie Patrick	18	of Obstragus	10	CYAND	_	CODON	401	0.1625	ĮI.	-		10		
Ф	Lake Papics	8	Browells.		CYAND	_	CORDAY	104	0.0023	Į.	-	-	10		
10	Later Patrol		exhimin firmit	12 11	CYAND	_	flament	400	0.0025	12	+	+-	10		
10	Lake Fatics	199	Flarktshydbys -	Investor	CYARD	-	Saror	201	92.0	H	-	*	m		
w	Lake Patrol		of Harrens	100	CYAND	-	Samer	200	670	H	7	-	R		
œ	Late Patrici	38	Calabria	atoda	CYXBO	1411	Sament	101	382.53	1	-	-	140		
AD.	Lake Patrick	8	cyandohyle flament	10 00	CYANG	ч	Samen	100	283.53	-	+	-	*		
10	Lake Fanch	88	Lyndova	11 01	CYANG	_	Danen	100	188.53	-	ī	-	ī		
	Lake Panci	8	thingshife colony	(S) II	CHLOR	->	Columy	400	11405	22	-	-			
40	Living Patricia	18	uncell schere 2.5 Sum	100		100	feet	401	0.18055	22	-	-			
10	Lake Patrols	18	Eufetignoss	99	CHLOR	×	Auges	400	0.1829	S.	-				
0	Lake Partick	18	cereic diatom	tti. Disfumi	BACIL	20	Tag .	400	0.0025	22	-				
ю	Lake Papics	16	NESSCHA	10 A-Three	BACIL	×	193	433	0.0825	22	-	-			
AD:	Lake Patrick	88	Services datam	to A.*Them)	BACIL	×	883	403	0.0425	P.	-	-			
0	Later Petrols	18	Balantin	veds	CHLOR	K	Solony	100	0.0005	茫	T	-			
w	Lake Patrick	18	Docytto	10 (3)	CHLOR	(1)	Voice	401	0.3825	12					
AD.	Lake Panck	98	pennals datam	40 X=734m)	BACIL	-	100	400	111425	12	-				
10	Lale Patrol	98	Statisticm	str (mbe)	CHLCR	×	E	200	0.26	35	-	-			
100	Lake Pancil	8	Closterum	30 (TI	CHLCR	-	tel	300	97.0	31	-	-			
w	Lake Pancil	98	CBYIN'S CHATOM	10 EP-12sm	BACK		19	202	97.0	35	-	-			
Ф	Lake Patrick	16	Syredia	sp. (L=85km)	BACK	×	E	201	970	H	-	-			
w	Lake Platfol.	88	genite datim	10 3.=155um	BACIL	H	193	109	201.53	-	-	-			
10	Lake Platfich	8	Cerbitiatus		KANTH	×	cut	100	20153	-	T	+			
ND.	Lake Planch	50	Ritocimum	10.	CHLOR	×	Name C	101	283.63	-	-	÷			

	Description	-		and a	diam who	Contract of the Contract of th		-			(mil)		Indicated	The state of	- Charles	
34	Describeran				-	dames			(mark)	,	70		OHERES.	- Constant	UNIXERS	
4	1971er Pool East	S	Condition of the State of the S	10 00	01910	-	Taret	401	0.000				980	0.0	001	
١,	Tenter Port East	8	replation flament	10 GI	CYAND		Taret	403	0.0825	100	7		346			
PY	Tenter Hond East	88	Aphanacapsa	크리	CYAND	E	- August	400	6080	27	e	-	330			
h	Terrier Pand Bast	8	Anahaena	dischalls flos-squae (1)	CYANO	100	flaneri	200	0.25	30	20		101			
h	Terrier Pand East		Anabasna	- F - F - F - F - F - F - F - F - F - F	CYANG	es	filament	600	0.0625	70	n		8			
m	Terrer Food East	18	Dysophyb flamen	11 11	CYAND	শ	farmi	500	0.36	35		-	g,			
*	Tentier Pand Best	8	Anabasera	9	CYANO	e	flament.	200	0.25	8			n			
	Terter Pool East	188	Policianabana	10 11	CYAND	_	Marror.	401	11825	77	-	-	F			
Po.	Terrier Pont Gast	8	Panutanabarra	CHARD	CYAND	_	figner	203	0.35	H		***	13			
-	Tarter Pool East	99	Lundhia	10 H	CVAND	÷	Sarror	101	183.53	+		**	7			
100	Testar Food East	8	Minesphäum	contactum	CHLOR	-	161	433	0.0625	P	P	900				
84	Tenter Pont East	8	Managhdam	median	CHLOR	×	Tall 1	-100	0.04055	100	-					
1	Tenter Pont East	8	centric diatom	80 (D=5um)	BACK	×	183	403	0.0025	į.		-				
p.	Tener Pond Ess	98	uncel, sthere 15-funi	100		×	689	409	0.0625	#	m	-				
300	Tenter Fond East	8	Maneraphidum	circinale	CHLOR	×	B	100	0.0025	22	7	-				
*	Terler Pund East	8	Fardatta	morum	CHLOR	×	60000	401	0.08035	22		-				
m	Tenter Pond East	8	uncal evanod 25-bun	100		×	1917	401	0.18235	SI.	E.	40				
n	Tenter Pond East	8	Cloaterium	acutamyar yarlable	CHLOR	н	193	401	0.0025	72	-	-				
h	Tarrer Pool East	66	Folenta	tangentar, varables	90TO	×	191	433	11825	12	-	-				
Jan.	Tenter Fond East	90	Displanta	9	BACIL	×	gara.	403	0.0425	22	n	11				
b.	Tenter Pond East	19	Sametru	to fred	CHLOR	K	para .	401	0.04255	22	r	-				
	Texter Pont East	98	drientaffyte polistry	100 000	CHLOR	-	Audico	401	0.3825	P						
h	Tenter Pont East	98	Butthanons	09	CHLOR	-	Modu	403	0.0425	- E						
pi,	Terrer Pond East	98	permate datum	sp. 2-25sm)	BACIL	×	10	400	E MOS	把	575	-				
-	Tester Pont East	8	Ankistodismus	cf. goscile.	SELCR.	×	Cell	401	0.0625	218	~	,				
-	Tenter Pond East	88	Washis	to (L=2)lany	BACIL	ja j	E)	401	D.H.CS	22	-	-				
-	Texter Pont East	18	Meetraphdam	prifith	CHLOR	×	H	107	0.0825	22	•	-				
*	ferter Pond East	8	Cogecum	171 08	CHLOR	-	Eel.	409	0.1925	22	-	-				
An.	Tener Pend East	8	Docyddi	10 131	CHLOR	×	Auto	403	0.1825	#2	-	+				
per.	Terrer Pond Sax	95	crimophyte sugite cell	32	CHLOR	-	H	400	0.1825	22	-	-				
*	Tarter Pool East	8	Scandolman	10.177	CHLOR	×	Autop	401	0.003	#		÷				
Jan.	Tenter Foot East	g	Byreday	10. E,=43em)	BACIL	*	960	403	0.0625	11	7	-				
14	Terrer Pond East	8	Scenederman	101111	CHLOR	×	followy	403	118626	芫	7	+				
key !	Tenter Fond East	g	Clostyroppis	30	CHLOR	H	tel	200	0.75	Ħ	er.					
ы	Tenter Food East	g	rantisc datom	to Children	BACIL	ec.	10	200	952	31	n					
ь.	Tenter Pont East	18	chinophyle colony	(II)	CHLOR	jsc.	Kuapo	200	0.25	30	7	-				
ъ,	Tester Pont East	88	Bestuffer	vide	CHLOR	ж	Rubba	100	0.25	11	m					
h-	Tener Pool East	88	Czsimeniam	30 (1903)	CHLOR	×	tell	200	200	H	7	40				
p.	Yester Food East	8	Sorrochisms.	tallac	XANTH	×	para	203	0.26	31	7	-				
200	Texter Pond East	8	Bothystorous	90	CHLOR	Sel	Kuoca	202	0.25	H	e e	31				
þ.,	Texter Pond East	98	Lagerhernia	100	CHLOR	×	test	200	20	35	7	w				
М,	Tenter Pond Sast	8	Psychotherstrum	17	MANTH	-	THE COLUMN	200	0.26	H	77	-				
14	Turner Plend East	8	Trestans	adminde	CHUCH	=	100	200	0.75	33		-				
ь.	Tenter Pond East	8	Executive.	TO (MON)	CHLOR	100	(m)	100	18151	-		-				
Pail	Terrer Rond East	s	4nlistndermit	falcetos	CHLOR	H	B	100	18153	-	0					
n.	Tenter-Pont East	8	Chapterite	mortes	CHLOR	38	Colony	100	183.53	-	-	-				

		The state of the s			discount or the last		The State of the last	-							1	
1						(America)			(mark)	,	70		OHERWISE.	Table Street	UNISH	
0		g	Eyet Oprige Tlament	10.11	CYANG		Throng	400	0.0625	100		100	245	1,501	æ	
00	Terter Pond South	98	Aphanist apsa	E 4	CYAND	0	CORNY	401	0.0825	100	-	-	7			
03	Texter Fond South	88	Aphunicapsa	E 8	CYAND	m	Column	400	9295 0	22		*	751			
100	Tesser Fond South	8	DSCAthrian flamen	111	CVANC	0	flaver	411	11.882%	p			194			
-	Terrier Pond South	25	Anabasha	50 dg	CYANO	27	flament	202	0.25	8			181			
	Terrier Pané South	25	Ansbeens	circinalis/fies-squae (1)	CYAND	di	filment	200	0.26	30		-	113			
900	Terter Pond South		Syllophys flames	10 13	CYAND	n	Maner	401	0.003	22	-	100	9			
10	Tarter Pend South	8	Aphanistapis/Choococous	10 M	CYAND	_	COUNTY	200	0.75	Ħ	7	-	12			
0	Terrer Rend Study	18	Aphanithece	# 15	CYAND	_	trates	200	0.36	H		-	12			
AD)	Tarter Pool South	19	Datophye flament	10 70	CYARD	÷	Syriet	101	183.53	+		*	7			
Œ	Tester Food South	8	of Promissions	10	CYAND	Ţ	Samer	101	183.53	+	P	-	**			
00	Terter Rond South	8	Pandanta	monum	CHLOR	×	(copur)	-100	0.0625	130	-					
Ф	Tenter Rond South	8	Teosestella	0.0	XAMITH	×	(84	403	0.8825	10	77	-				
10	Terier Fond South	98	Scenedama	8	CHLOR	×	CDONY	400	0.0625	#		-				
œ	Tenter Fond South	18	Synedia	Ħ	BACIL	- %	Ti.	100	0.0425	27	7	-				
100	Terler Pund South	18	WESSTA	50 E=15sm0	BACIL	×	107	401	0.0625	22	-	-				
10	Tenter Pond South	8	contro diatoro	30 (D=7 fum)	BACIL	×	193	401	0.0025	100	P					
103	Tenter Pond South	18	Statistica	tti paed	CHLOR	×	193	400	0.0025	22		-				
10	Terrer Post South	10	Christmann	111 00	CHICK	×	191	433	0.0825	12	-	-				
40	Tenter Fond South	98		languaga f. vortebilis	CHLOR	×	0.00	403	0.0425	22	77	-				
100	Tenter Fond South	19		B	SHOR	×	taca	103	0.0425	P.		-				
100	Texter Rond South	18		10 S. * 13sm)	BACK	- 34	100	400	0.3825	P		*				
0	Tenter Pond South	98		Certifials	CHLOR		103	403	0.7825	<u> </u>	73					
œ	G.	98		100		×	H	400	0.0425	22	-	-				
80	Tenter Rond South	98	Anketodesmes	practies	CHLCR	-	Cell	403	0.9625	718	್	-				
0	Terter Pond South	98	WZSChia	10. E=37um	BACIL		(e)	401	0.0625	22		-				
CD.	Texter Pond South	18	Clouderopsis	şi.	CHLOR	×	H	107	0.005	22	•	-				
10	Terrer Pond South	88	Hirthopiells	171 08	CHLOR	-	Autop	400	0.1825	22	-	-				
ю	Terrer Pland South	16	DYDOUGHASS SABJE CHIL	10	CHLOR	×	CON	403	0.1825	27		+				
Œ	Terrer Pont South	18	tarest datom	44 De75)	BACH	-	Ŧ	400	0.1825	22	77	-				
10	Tarter Pood South	8	Hiroboprailla	10.125	CHLOR	×	Auto	401	0.003	77		-				
100	Terter Font South	g	Treateria	schride	CHLOR	*	Coll	403	0.8625	T.	7	_				
a)	Terrer Pond South	8	Manoraphidam	flesson, m	CHLOR	×	Ti.	403	11,002,55	P.	7	+				
60-	Tenter Pond South	15	tentric dietom	IN El-Simi	BACK.	×	tel	401	0.8825	12	es.					
00	Tenter Food South	88	Eufetranomia	10 (1)	ELOR.	ec.	A4000	403	0.0625	17	0					
Œ		8	Scenetiesmus	10(1) 15	CHLOR	jK-	happy	401	0.0625	22	7	_				
100		B	Charaphyle colony	10 (0)	CHOR.	н	Autor	400	0.0625	2	m	-				
80		8	Orgitophyle	sp fortess	CRYPT	ic	263	400	0.28255	157	77.	40				
œ		8	Tetrastrum	elegans	CHLOR	×	colony	200	0.26	11	-	-				
10	Tenter Pond South	8	Disciplina	up (large)	CHLOR	Sec	193	202	0.25	Ħ	·	34				
10	Tenter Pend South	60	Antistochomes	falcatus.	CHLOR	×	200	203	200	30	-	w				
CE		18	Informachinum	gracity.	MANTH	-	190	100	29.155	-	77	-				
Ф		8	Coomenum	10 PHG	CHLOR		000	101	103.53	+		-				
0		8	Docytte	10 (2)	CHLOR	×	Kugga	101	183.53	-						
a ·	Texter Rend South	8	thinophle flament	19	CHLOR	×	farrer	100	18153	-						
29	Texter Pont South	8	Preudottarratum.	D	CANTH		E CER	100	383.53	-		-				

				(STHER)					76		CHEEFING	CHRIST	Chitten
18	Aphanicipsa	10.141	DYAND	-	COIDA	401		120		-	454	480	*
99	1925 Sabblan Sament	TO GE	CYAND	-	Seren	200		Ħ	7	per	R		
8	Aphanacapsa	92.07	CYAND	77	Autigo	103		+	-	90	4		
8	Planktothrix	agandhilmouseotti	CYKNO	173	flaneri	100			-				
8	Anshenx	1000	CYANG	_	filament	901			7	-	-		
8	drinnahyte soliny	0.0	CHLOR	×	Kungo	401		22	-	-			
90	Statistics	10 31601	CHLOM	×	celt	401		Į.	-	**			
8	Choyate	10 13	CHLOR	-	COUNT	104		P.	-	_			
8	uncell, uphers 3.55um	811		-	THE .	400		12	+	***			
99	Antigodeshor	of gradity	CHLOR	×	000	401		PT.	-	90			
8	Bastebro	verds	CHLOR	-	AUGUS	433		12	7	90			
98	thismshille adamy	100	CHLOR	×	Augus	100		138	-	-			
8	ceres; dietom	80, ID=7 Sumi	BACK	H	(84	409		Į.	+	-			
90	Clossours	SCIENTIVE VERSIDE	CHLOR	ж	883	409		12	ī	-			
8	Scenedeuman	100 mm	CHLOR	->	Auto	400		22	-	-			
8	000/08/5	10 00	CHLOR	×	Autoria	401		22	-	-			
8	Obcydłu	11.00	CHLOR	×	Augo	400		100	-	-			
8	Eutetranorus	11	CHLOR	N	Autora	400		罪	-				
60	Materiphidum	gifts	CHOR	×	tel	433		42	-	-			
90	Docystic	20 20	CHLOR	×	Avogo.	403		12	-	-			
19	Certificacian	9	NAME	K	test	100		200	ī	-			
90	Kelafa	tangons t variable	CHLOR	(M)	100	400		P					
98	Czemanam	to pred	CHLOP	×	103	403		<u> </u>	7	*			
98	Eustram		CHLOR	×	ten	400		把	-	-			
8	Duschgals	OLENSTRIB.	CHLOR	×	CORDA	401		718	-	-			
8	Scenedeanus	10 (20)	CHLOR	(m)	Autico	403		72	-	-			
18	Scientesta	を	CHLOR	×	colony	200	97.0	Ħ	-	-			
8	Authobarea	8260	BACK	×	chem	109		-	-	-			
38	ERONAM ANDRON	no it suttant	613/75		6.00	100							

Sample	Sampling Date Genus	· Owners	obsciss	Algas Group		Counting Unit	Magnific atten	THING ACRES	0111100	Settling You.	Distribut Factor	Species	CTAMO INTE	PIET CTAND
					(numbs)	(nuts)				(H)		Unitralial	Unitabili	Unitshil
	8	Microcystis unicell	9	CYANO	123	980	900	0.0825	10			1.05.1	187.87	8,054
N 417459LB)	98	Moscyste	mesarbarak	CYAND	1	DROWY	403	0.8825	123	-	***	1878.		
10 4174-Sauth	8	Anabaena	circinalisfios-aquae (1)	CYANO	z	filanent	007	0.0625	20	-	-	706		
10 4174Sulfn	8	Aphantcapss	10 (1)	CYKNO	wi	Autogo	400	11835	11	-	#0	124		
10 4174-Such	90	ssolubilar flamen	127 01	CYANG	107	Namer	400	0.000	ĮĮ.	-	-	324		
	160	Aphanicaps	王井	CYAND	7	Autoo	10	0.1025	25	7		259		
	8	Mareoystis colony	Grand da	CYANO	-	coleny	400	0.0625	20	-	_	88		
10 417-4-59ufti	8	Aphantiapia	10 [2]	CYAND	_	Augus	401	0.003	#	-	=	10		
10 417.4-Sauth		Ansthoens	000	CYANO	¥	filament	009	0,04255	72	7		8		
		Ansheenx	6 6	CYAND		Tilan ent	200	0.25	8	*		R		
		Planstothrix	-	CYANO	2	Filament.	9	282.63				ş		
10 417.4-South	8	Monecystis colleny	sp. (large)	CYANO	4	colemy	8	200.53				•		
		Ansthens	•	CYANO	4	filment	100	288.53		7		*		
		Resignation.	_	CYANG	m	Danen	100	183.53	-	ī	-			
		unicel, sphere 255um			×	B	100	11,025	22	-	-			
	18	Caeladoum	50 (7)	CHLOR	×	ALCOHOL:	401	0.00055	12	-	-			
	8	Historiella	10.11	CHLOR	×	Augo	400	0.0025	10		**			
10 417.4.5auth	18	Automorers	grandata	BACI,	×	distr	401	0.1025	22	-				
10 417459181	16	Scanode ansize	10 (20)	CHICH	×	Augus	433	111125	22	-	-			
	90	Scaradograza	521 98	CHLOR	×	Augo	403	0.0425	22	-	-			
	19	terms datom	as Dellan	BACH	×	par	403	0.0005	200	ī	-			
	18	Nezzha	10 f.=751m)	BACIL	×	pus	401	0.0625	P	-				
	90	Docyatio	60 151	CHLOR	×	Augu	403	0.0425	12	7	+			
10 4174.Suth	88	persate datum	sp (L<2llum)	BAOL	×	E	400	11,0425	22	=	-			
10 4174Stubi	8	Treatens	schmidei	CHLOR	×	tel	401	0.9825	24	-	-			
	8	Hirdmenella	10 (2)	CHLOR	×	V1000	401	0.0025	22	-	-			
10 4174.Smb)	18	Occyda	回り	CHLOR	×	coluny	107	0.0025	22	-	-			
	8	Bultismons	9	CHLOR	×	Autor	400	0.1926	22	-				
	8	Scenario graus	Dickdohan	CHLOR	×	coons	403	0.1825	#	F	-			
	15	Pandatha	manan	CHLOR		August	201	0.26	11	-	-			
	g	Authobiery	cours	BACH	×	thun	200	0.78	Ħ	T	÷			
	18	(listom chain.	10 (0=125)	BACH	×	than	200	0.76	H	T	_			
10 417.4.Sn.#1	98	Nemetra	to 3,-3lum	BACH.	×	Ti.	200	0.76	Ħ	t	-			
19 4174.Suth	15	Scenedograus.	10 03	CHLOR	H	coppu	200	0.25	Ħ	-				
	18	Scenedeanus	guadicaida	CHLOR	ø	coppy	101	18153	-	-				
	18	latimodianon	grade	XANTH	K	193	100	383.53	+	~	-			
	88	Statestara	50 P1963	CHLOR	ж	192	103	283.53	-	7	-			
	88	Closterium	10.171	CHCOR	k	ced	100	280.83	-	~	-			
10 417.4.Secth	8	Periodinan	proper	CHLOR	×	August	100	282.52	10	-	-			
	900	Enablished Starrendays (2900)	rightsp 94	CHLCR	×	Harrert	103	283.53	1		je			

	Sample	Sampling Date Genus	Canal	Shecies	Augus versup	# Charmed	Countries unit	Magnifect atten	FIRM ACRE	8 OF THE OR	Setting You.	Distribut Pactor	Species	CTAMO INTE	THE CLASS	
	Description					(numbs)			(Jump)		(14)		Untraferi	Unitable	Unitabili	
=		16	Aphanocapina	10 4	DYAND	I	August.	401	0.8625	22		**	4145	11,036	5,807	
F	417-3-South	90	Anstraena	circinslis/fos-squise (2)	CYANO	-	flament	007	0.0625	70			3.963			
F	417-3-Seuth	e e	Moreoystis unicell	8	CYAND	77	lac.	600	0.0625	20			1,565			
1		8	reclabitar flamed	62 68	CYANG	=	faver	401	11835	TI.	-		949			
=	417-3-Sauth	25	Anabaena	(g) ±	CYANG	n	flament	009	0.04055	20	7	-	76			
=	417.5.Seuth	10	systophye flamen	0.0	CYAND	т	Saran	40	0.0026	灵	-	***	154			
F	417-3-Sauth	8	Morecystly colony	4p (km)	CYANO	n	calany	400	0.0625	20	-	_	761			
=	4173-3910)	8	rockstoten flament	10 111	CYAND	-	Bamph	III.	610	Ħ	-	_	100			
Ξ	417.5.Shuby	18	Pandmibiers	Innesta	CYAND	-	famer	400	0.0025	112	+	+-	16			
Ξ	417-3-Spub)	99	Lividhia	12 01	CVARD	÷	Samer	101	183.53	-	-	-	۳			
F		8	Raktitivo.	11.01	CYAHO	m	Saner	101	283.53	+	7	-	m			
Ξ	417.3.South	98	pasophia filment	10 M	CYXNO	2	Samen	103	382.53	1	-		-			
F		8	Restation	60 00	CYANG	_	Daner	101	183.53	-	٠	-	T			
F			Withrights	01	CYANG	-	Audigo	100	183.53	-	ī	-	-			
Ξ	417.5.Stub)	8	Communitri	III (ned)	CHLCR	->	E	400	11425	35	-	-				
F		8	Scenedernia	100 1123	CHLOR	ж	Autor	401	0.0605	12	-	-				
F	10	8	Chicrophyte tollery	50 JA1	CHLOR	×	Augo	400	0.000	100	-	-				
=	417.3.5suth	8	Districtive	virds	CHLOR	N	Autos	400	0.0025	72	-	-				
1		60	Sciriolismos	10,171	CHLOR	×	6000	400	0.0825	27	-	-				
=		90	uncell, gamer 2.5 Sum	101		×	582	403	0.0425	12	-	-				
F	417.3-South	19	Sayththm	to pred	CHICR	K	Dist.	401	0.0625	22	-	÷				
=	417.5(5)(8)	93	Merschia	00 E=2hm)	BACIL	×	103	401	0.3625	12	-					
Ê		i	Koleta	Impodat varable	CHLOR	×	193	403	0.0625	100	7	+				
			Scenedesman	(以) 出	HOH:	×	colony	400	11408	27	=	-				
=	41755816		Euterbanghan.	10	CHLOR	×	Kuggo	401	0.9625	100	+	-				
		1	Oncytte	5 55	CHLOR	×	CORNY	401	0.1625	22	-	-				
=	417.5 Stuby	18	permitte datam	sp. p. 254m)	BACK	×	FE CE	107	0.0826	22	-	-				
F		8	Sceneteening	50 GS	CHLOR	×	Autop	400	0.10255	ž.	-					
F	417-3-59-001	160	dribrophysy collery.	10.01	CHLOR	×	Audico	403	0.1825	77	ī	-				
Ξ		18	Oustreach	challerints.	CHLOR	-	stimy	433	0.18055	22	-	-				
F			Pandottia	moran	CHLOR	×	Autoo	401	0.0025	77	7	¥				
=		88	chicrophyte single cell-	10	CHLOR	×	Cel	403	0.8625	11	T	-				
=	417.5.5mm	98	Shinston	to lorall	CHLOR	×	Tel:	400	11,082/6	12	t	-				
Ξ		15	Scenedering.	guadricands	CHLOR	H	colony	401	0.0826	12	-					
F		18	Charlophyle solany	100 00	CHLOR	ec.	World	403	0.0625	111	-					
=		18	Coefectium	NU (2)	CHLOR	ж	Auges	200	0.16	30	-	-				
=		98	centric datom	No (D=154th)	BACIL	ж	193	203	0.25	11	-	-				
Ξ		88	Docystis	Sp. (2)	CHLOR	×	Kudgo	203	620	H	~					
=		8	Casmanium	5th (SM)	CHLOR	×	tel.	203	0.25	35	-	-				
F		8	franched hismentous chion	01.40	CHLOR	94	Marriere	101	283 53	+	-	,				
Ξ		90	Vaucheria	- Ot	хинтя	×	Namen	100	18181	-	-					
=		98	Pandonna	moram	CHLOR	-	Augs	100	282.52							
Ξ	417.5.Snuth	90	Automera	100	BACH.	-	than	193	703.53	1	-	-				
١																

Description					(numbs)			(2mm)		(10)		Untrafer	Unitaried	Unitshill
417-1-South	8	Mortoystis unicell	•	CYANO	2	180	900	0.0625	8		2	16,231	33.540	20.691
417-1-Stuffs	90	UmothisPaushams	- 10	CYAND	-	Sarget	403	0.8825	25	-	12	6.351		
417.1-Snuth	8	cyan ophybe filament	(E)	CYAND	e e	fisher	400	90910	200	-	9	2722		
417-1-South	8	Microcystly colony	5p. (3s ed)	CYKNO	22	coleny	82	0.25	8	-	g	2,722		
417-1-Stuth		Aphanicipsi	in in	CYANG	41	Avado	403	0.000	55	7	12	1.8%		
417-1-South	8	Morecystis colony	10-(km)	CYANO	10	caleny	200	0.26	00	ā	2	1,134		
417.1-08.001	10	Potudanabaera	10,111	CYAND	-	Maner	401	0.0025	15	-	10	387		
417.1-Stuffy	8	symphys forms	10.00	CYAND	_	Mampri	401	0.003		-		367		
417.1-Sauth	8	Anshoens	6) 4	CYAND	e.	filament	900	110	8	7	8	757		
417-1-Stuff)	99	Showiffa	10	CVAND	-	Kuggo	202	970	15	7	12	131		
417-1-Sauth	8	Ansheenk	circinalisfics-equae (1)	CYAND	e.	Filament.	60	283.63			Ş.	8		
417-1-South	8	Micrecystis colony	sp. (targe)	CYANO	es	colemy	8	20053	F	-	2	R		
417-1-Seuth	28	Planktodnik	agandhilmougectil	CYANO	-	filment	100	283.53		7	8	9		
4175.89,00	88	Lyngbys	10 01	CYAND	_	ganer	103	183.53	-	ī	9	10		
和社会局	8	esolatoran flament	E#	CKAND	+	Saret	100	183.53	+	=	ű.	10		
417-1-58UE)	88	uncell spree 155um	100		×	test	400	0.000	15	-	2			
417-1-39uB)	8	Scenedeshus.	guidosoda	CHICAR	×	coory	401	0.0025	200	-	0			
417.1.Sauth	8	proof, cyalled 15-but	601		×	B	403	0.0000	15	-	2			
417-1-39(8)	6	Activation	hartzutki	HOH.	×	Addd	433	11825	111	-	2			
417-1-Stuffs	8	Cronphyte skiller skil	88	ELOH ELOH	×	982	403	0.0425	25	-	10			
47.1.58時	19	driensthive toleny	10.00	GEOR.	k	huges	100	0.0625	25		2			
417-1-58(8)	g	Spinodo smus	10 (0)	EH,OR	×	Kopp	408	0.3825	ii.	*	P			
4171Std	8	DBME distorn	60 10=7 50	BACIL	×	100	400	11,1425	(F		p			
4774.84	8	of Arshabotesmus	sp (L=27km)	CHLOR	×	THE CHI	200	920	25	-	12			
4171-39.00	g	Actionstium	postitienm	CHLOR	×	Kugo	203	970	25	-	10			
417-1-58(8)	8	Scenedeanus	10 (12)	CHOR	(H)	COUNTY	202	970	15	_	9			
417.1.Smb)	8	Infritodilition	proje	XAMTH		B	100	18150	-	-	2			
4 A LOBORY	8	Codmins	100	CHCCK		127	100	283.53	-		-			
417 Cilderth	8	Planktadetix	aganthilmougeotti	CYAND	2	filan ovt	600	0.0625	8			9,617	17,576	1202
417-2-North	8	Morecystis uncell	ź	CYANO	g	¥	400	0.0825	8	•		2,722		
417,24000	g	sociation in travers	10.13	CYAND	m ,	Marror.	401	0.003	II :	T)	na e	7900		
417 2 North	8	Morecystis colony	th (tw)	CYANO	10	colemy	600	0.0025	8		**	907		
417-2-North		Ansheens	cincinativities-squas (2)	CYANO	*	Flament.	600	0.0626	8		pe i	726		
7-2-10mb	81	Aphanic apsa	10 01	CYAND	m i	August	400	0 860				7		
417.2.Morts	8	Pseudinabaera	imenca	CYAND	-	Harrer	401	0.8625	11		n i	707		
417-2-1003	5	Day opryte Ramen	10.11	CYANG		Ramer	401	0.3525	7.5			200		
all them	1	description county	the disease	CHANG		duament of the same	100	11000	8 =			9 1		
417 A 41446	9.8	Aprilability Street	53	CAMP		No.	200	0.000	1 1 1		4.5			
ANTAGARAN	3	Mecanismis colonic	St. Assess	CVENC		college	000	969.69				8		
217, Laborto	8	second solvers 1 & Sum	And and add			540	403	0.0006	. 09			ı		
417.7.3.byth	甚	Managed	and other	CHICAR		100	100	0.0828	15		ı r			
417.0.44prth	18	Schundena	106.001	CHICAR		3	400	0.000	100					
417.3.hierts	8	Chefastran	100	CHLOR		region	403	0.000	105	Ť				
417.23Abrth	18	throughte state cell		CHCOR		100	403	0.000	15	-				
417.33 brth	15	Scandishasi	modificada.	CHICE	G	coops	433	1000	15					
417.3 Mort	199	Tetretton	Cautatam	CHLOR	×	TE C	403	0.8425	35					
7-2-North	8	Gonochisms	mtos	XANTH		Ti.	403	0.8625	15	-	r			
7-2-10/0	8	of Antighodesmus	38	CHLOR		183	400	0.11628	25	-	r's			
412,334,000	99	sering distorn	sp. Delbuni	BACIL	×	E	101	0.18255	H	T	44			
417,27-both	8	Mangraphdum	contatum	CHLOR	×	183	401	0.0625	31	-				
417.3 North	98	introchlaron	gracity	SANTH	×	CBB	E C	E 0	115		FI			
417.2 Month	18	Schussieta	tadian	CHLOR	-	H	201	W 0	iii	-				
417/24/00	8	Scanede umos	SCHEMBLE	CHLOR	×	ctiony		910	115	-				
7.2-8-brts	8	Fediatrum:	duples	CHLOR	m	coory	100		-		es)			
417-2-4005	9	Pardones	- eventura	CHICON	-	Auges	198	183.53	4	100	(e)			

Column	Description	Sampling Carls Gentle	1000	Species		(underly	outeng unit	Magnifections	(may)	# of P1810s	Cell Year	Distribut Pactor	Species	CTANO IND	Cheminal Committee
Comparison Com	a Credel Swift	ñ	Same obdeato filonami	9 3			Sharper .	4119	2000	9	7		11 880	18.417	1554
Comparison Com	County South	8 8	Applications comment	10 F3		15	Difference of the last	400	1000	5 17			4710	7144	- 171
Control Cont	CONTRACTOR SOUR	83	Spirate appara			2.3	Canal Control	200	2000	2 5		. ,	2 9		
Control Cont	Contra South		Aphanicapsa	10 D		Z.	(units	100	0.000	2			277		
Continue	Condel South		Moreoystis colony	45. (km)		2	caleny	100	0.0625	8	•	-	1.03		
Comparison	Condition to the		systochyc flament	E 23	CYANG	0	Marriera	400	0.000	15	-	-	111		
Comparison	Condel South	8	Mersmando	punchia	CYAND	-	county	9	0.0026	25	7	per .	913		
Co. Challed State (1987)	Condel South	5	Morecystle unicell	~	CYANO		W o	400	0.0025	8	-		777		
Common Security Application of the common of t	Upos Mpuos	1	Aphanicipia	-	CYAND	ur.	COUNTY	104	11103	ii.	-	_	454		
One of the control of the co	Carde South	1	Aphanat appa/Choocactur	Ħ	CYAND	ie.	(HILLIA)	400	0.0055	and the		***	454		
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92	HOTELO JOVINE	ì	Aphantippsa	10.11	DYAND	up-	COIDS	400	0.0625	25	m	**	191	E 15	100
业	Horato 2 @ Wee		Aphanicapsa	10 H	CYAND	n	Augen	433	0.0825	20	7		18		
2	Hormo 2 th Wer		Cyanaliamet	100	#03	Ξ	488	200	0.26	20	e	-	60		
10	Horato 2 @ Wer	8	Aphanicipsa	10 01	CYANG	204	Nu000	433	1,1635	15		**	9		
耸	Horsto 2 @ Wer		Chroscottas	9	CYAND	-	Augus	400	0.000	200	n	-	20		
9	Horsto 2 g Wer	8	collet cyanophyte	世世	CHANG	_	Saner	403	0.1825	210	7	-	я		
2	Horsto 2 (2) Wer	88	systochide (Ingle cell)	10 Ting)	CYAND	_	colt	401	0.11625	225	e		R		
92	Horsto 1 @ Wor	8	syndphys familit	22 23	CYAND	_	Barrer.	104	0.002	115		-	R		
2	Horato) @ Wer	8	Aphanitigus	0.11	CYAND	_	tratery	400	10000	100	r		30		
10	Horato 2 @ Wer	99	Oxillation Sament	10.11	CYARD	т	Saron	201	0.75	15		ja.	m		
92	HOTED 2 @ Viber	8	Pseudanabasea	036839	CYAND	69	Saner	200	0.75	100	n	-	in.		
#	Heratio 2 @ Weir	8	Planktethrix	agandhilm eugeoti	CYANO	÷	filament	200	0.25	80					
#	Heratio 2 @ Wish	25	Morecystis colony	\$40 (km)	CYANO	-	coleny	100	283.53		m				
92	Hormo 2 @ Wer	98	uncet street 15 fun	100		H	883	400	0.0625	25	m	-			
2	Horato 2 gg Wer	8	drinnshipte colony	(i)	CHLOR	×	Autor	77	11005	100	7	-			
*	Horsto 2 @ Wer	8	Fardons	HOUR	CHLORE	×	Audigo	401	0.0605	100	r	-			
2	Horato 2 @ Wer	8	Antitadesmes.	cf. gritotis	CHLOR	×	1917	400	0.0025	200	n	**			
2	Horato 2 @ War	18	Cloderiques	22	CHLOR	×	tel	401	0.1025	25					
\$2	Horsto 2 @ Yher	60	Mynoraphotes	supportuni.	CHLOR	×	rest	403	11100	10	m	-			
蛇	ногию 1 ф Инег	90	Dictylishbarium	111 85	CHLOR	×	Avada	403	0.0425	15	17	-			
2	Horato 3 g Wer	18	Scaredowns	12.14	CHLOR	K	Augo	100	0.000	125		-			
华	Horato 3 @ War	93	drionsphyte steple call	- 00	CHLOR	×	100	401	0.0825	ii.	-				
92	Horato 2-@ Wer	90	Witscha	60 L=41sm	BACIL	-	103	403	0.1425	100	m	+			
空	Horato 2 (2) Wer	8	Manaphdam	pritts	HLO9	×	E	400	11,0425	25	571	-			
92	Horato 2@ Wer	8	CHIDITAGLS	10	XAMEN	×	(eq	401	10,000	15	7	-			
90	Horno 1@ Wer	8	Scenedering	gradicacds	CHLOR	je,	count	401	0.005	15	5	-			
9	Horato 2 @ Wer		pertition diations	sp. (D=10am)	BACIL	×	TE C	107	0.0426	SI .	***	-			
2	Horato 2 @ Wer		Eudorina	10.17	CHLOR	×	Autor	409	0.19255	22		-			
\$2	Horsto 2 @ Wer	160	Monothum	03	CHLOR	×	Auto	400	0.1825	215	-	+			
垒	Harato 1 g Wer		Consochiens	of false	XAMTH	-	Ħ	400	0.1025	107	7	-			
92	Horato 2 ⊈ Wer	8	gennate dietam	10.1.4371410	BACH	×	Cell	401	0.1025	H		¥			
92	Horsto 2 @ Wer.	1	Placut/apprings	10	8,03,	×	163	403	0.0625	II.	7	-			
92	Horato 3 @ Wer	ì	Mercraphidem	accultura	CHLOR	×	Ti.	403	11,002.5	GR.	7	+			
W.	Horato 2 de Viter	15	unioninentlageliste	100		H	tel	401	0.0825	m	m				
Œ	Horato 1 @ Wer	1	Maneaphidim	PORTUGATO.	CHLOR	e	101	403	0.0405	15	n				
92	Horato 3 (B.Wer		Materiaphidam	circinste	CHLOR	js;	E	401	0.0055	200	7	_			
Ľ	Horsto 2 @ Wer	88	Scelegins	30 (V)	CHLOR	ж	RJ0000	403	0.0625	15	m	-			
堂	Horsto 2 @ Wer	1	Tebastion	PARTICULAR STREET	ELCA ELCA	k	193	400	0.0025	15	7	-			
	Horato 1 g Wer	1	Schriedera	spraks	CHLOR	×	tes	400	111123	150	-	-			
	Horsto 2 @ VNin		Scenede small	10.00	CHLOR	SW.	Auges	200	0.25	22	T.	,			
	Horato 2 @ Wer	1	Tristhelonionial	9	870	×	100	203	0.75	8	7				
22	Horato 2 @ Wer	8	Chateriopean	#	9010	-	H	EE1 193	50	1000	77.1				
	Horato J. G. Wer		Docynta	10 H	CHLOR		CORNA	100	20151	-					

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